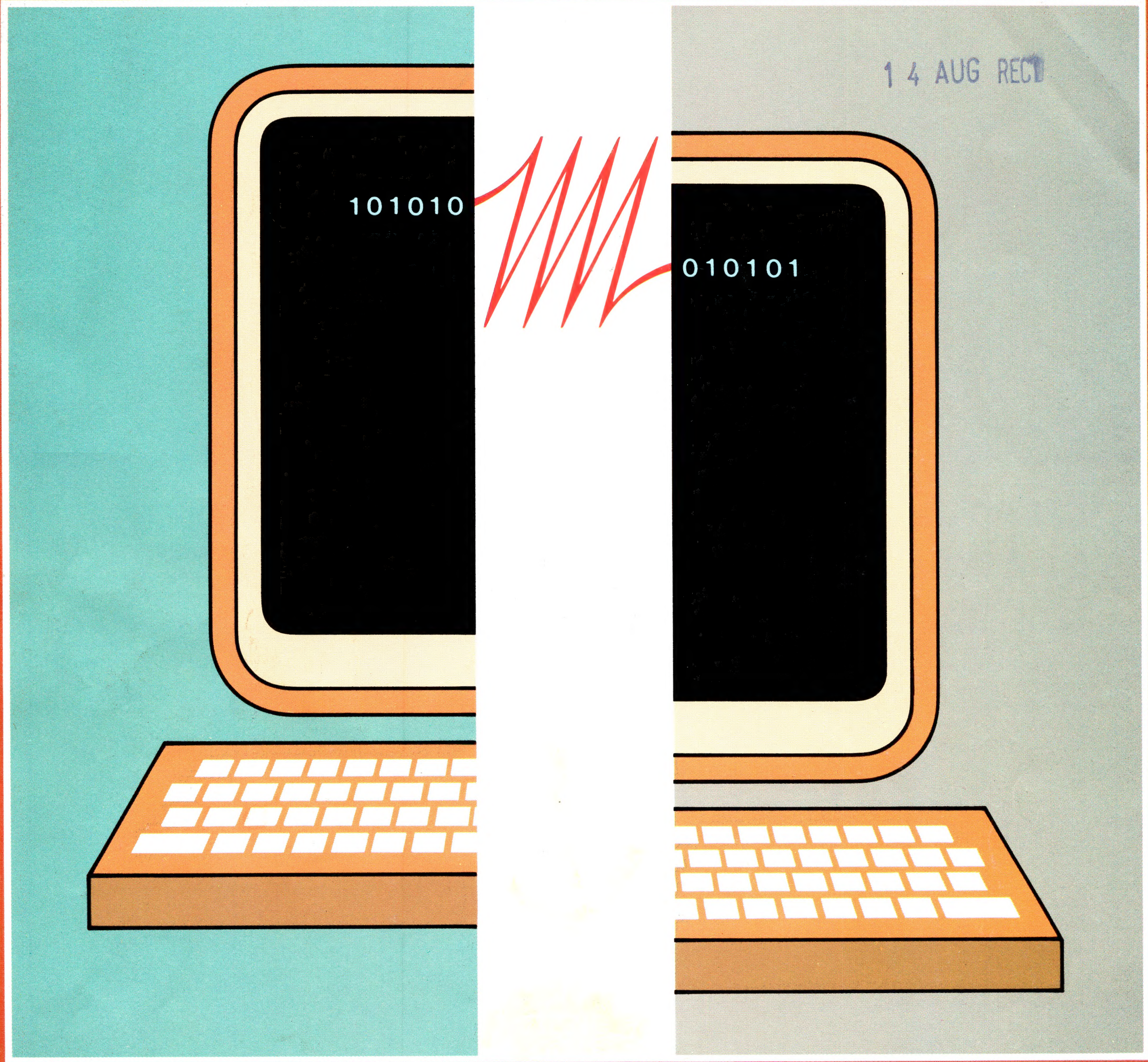
A McGRAW-HILL ELECTRONICS PUBLICATION
AUGUST 6, 1984 $3

ElectronicsWeek®

Philips Bold Adventure

THIRD IN PC SALES/57

LOCAL NETWORKS COME OF AGE/67



14 AUG REC'D

UK group striving for viable silicon-on-insulator semiconductors/31

New fiber-optic entrant backed by heavyweights/63

Translucent plastic film holds big promise for broad uses/75

BOB, CAROL, TED & ALICE

How Four Innovative Design Engineers Found Happiness Using The New DASH-1™ Schematic Design System.

BOB: "DASH-1 keeps me under budget and ahead of schedule..."

"DASH-1 has freed my designers from the drudgery of manual schematic design and documentation. Now, we can knock out complex designs in a fraction of the time it used to take. Using the huge DASH-1 parts library (on disk) we can instantly call up any symbols we need — all with pinouts and pin functions. Also, our amazing DASH-1's automatically generate Net Lists, Lists of Materials, Design Check Reports and other critical documents. I'm a hero in my company now, with productivity at an all-time high."

CAROL: "DASH-1 helped save our CAD Systems..."

"My company has a big investment in large CAD systems. But for a long time I noticed our engineers were frustrated. They'd send in schematic sketches only to get back drawings and documents that were completely different. The poor engineers would spend hours checking, changing and red-lining. DASH-1's family of CAD translators, to front-end all of our large systems, has changed all this. And back annotation is easy. DASH-1 has provided our engineers easy access to those previously difficult-to-use and inaccessible CAD tools."

TED: "Imagine! Simulation right at my desk..."

"I'm even more sold on my DASH-1 with its new simulator. After I complete my schematic, I have a closely coupled logic and fault simulator that I can run at my desk. I can analyze my designs much faster — and put them into production without delay. FutureNet calls it the DASH-1 CADAT.™ I call it a miracle because I can handle designs as large as 10,000 gates right at my desk, and up to 100,000 gates using a FutureNet CAD translator. Thanks to DASH-1, simulating is stimulating!"

ALICE: "DASH-1 keeps growing — as we do..."

"Ours was a start-up company — but it's growing fast. One of our first investments was a DASH-1 (about the price of an IBM PC or XT system) to speed up schematic design and documentation. Since then, FutureNet has added all kinds of low-cost enhancements. Things like CAD translators; direct-connections to most computers; the STRIDES hierarchical package with 99 levels of structured design nesting; the powerful CADAT simulator, pen plotter options, and hot new features, like Rubber Banding, Tag and Drag, and Snap. We're with FutureNet... for now and the future."

FutureNet, DASH-1 and STRIDES are trademarks of FutureNet Corporation. IBM is a registered trademark of the IBM Corporation. CADAT is a trademark of HHB Softron, Inc.
DASH-1 CAD Translators (Partial List): APPLICON, CADAM, CADAT, CALAY, CALMA, CBDS, COMPUTERVISION, GERBER, RACAL-REDAC, SCICARDS, TEGAS.

FutureNet®

FutureNet Corporation • 6709 Independence Avenue
Canoga Park, CA 91303-2997 • TWX: 910-494-2681
(818) 700-0691

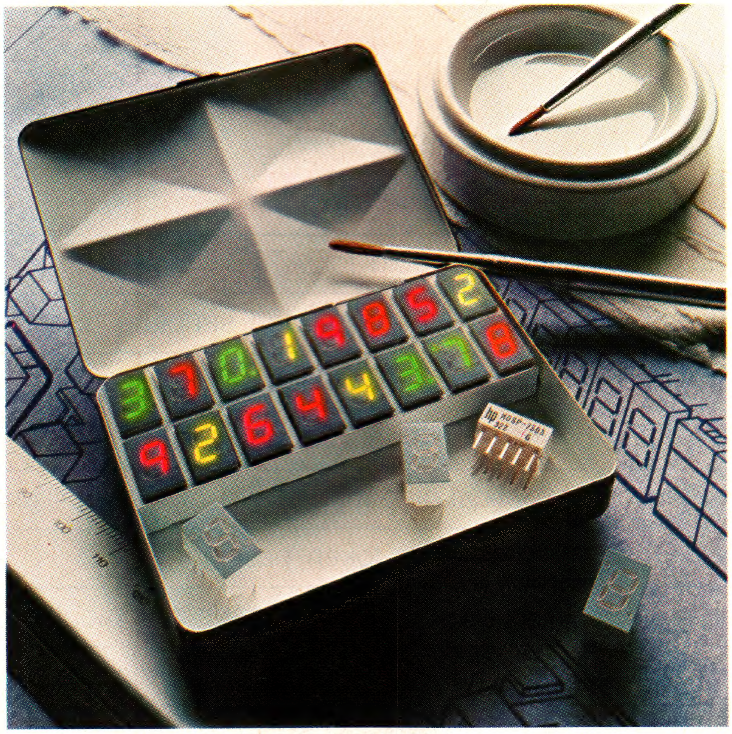
Authorized IBM Value-Added Dealer

Productivity of the Future... today.

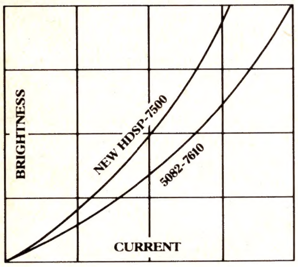
Circle 900 on reader service card

SURPRISE!

Add color to your bright ideas with HP's smaller 0.3" LED displays.



A smaller, brighter LED display.
One of the newest and brightest enhancements in LED technology is now available from Hewlett-Packard. Our new family of 0.3-inch displays can offer design engineers more flexibility than before. Offering smaller package size and increased brightness, this series of seven-segment displays provides some attractive solutions where space is at a premium. They have an eye-pleasing mitered character font that comes in four distinctive colors—red (HDSP-73xx), high efficiency red (HDSP-75xx), yellow (HDSP-74xx), or green (HDSP-78xx). And every one is pin-for-pin compatible with Fairchild's FND 350/360 series.



Now you can do more, with less.
Measuring just 0.3 by 0.5-inches each (7.6 by 12.7mm), ten of our high-performance displays can fit into a space of only three inches (76.2mm). You can power each display with 25 percent less forward-drive current and still see the same brightness as with our original family of 0.3-inch displays. This means excellent viewability at distances of up to ten feet. What's more, our new displays let you see brightness increases of up to 50 percent at drive currents of just 5 to 10mA. Ideal for high-ambient light applications.

A free sample is yours for the asking.
For a free sample and data sheet on HP's newest family of 0.3-inch displays, circle the reader response number, or complete and mail the coupon. For pricing and delivery contact your local HP distributor. In the U.S., contact Hall-Mark, Hamilton/Avnet, Pioneer Standard, Schweber, or the Wyle Distribution Group. In Canada, call Hamilton/Avnet or Zentronics Ltd.

In the U.S. mail coupon to: Hewlett-Packard Company, 1820 Embarcadero Rd., Palo Alto, CA 94303. In Europe: Hewlett-Packard, Nederland BV, Central Mailing Department, P.O. Box 529, 1180 AM Amstelveen, The Netherlands.

EW

☐ **I'd like a sample of your new 0.3" LED Displays.**

Name____________________
Company____________________
Address____________________
City____________________
State__________ Zip__________

8/6/84

HP: The right choices for easy-to-read displays.

HEWLETT
PACKARD

CG08313

Circle 1 on reader service card

A McGRAW-HILL ELECTRONICS PUBLICATION

ElectronicsWeek

NEW EXORBUS MODULE

The first to offer a 16-bit microprocessor, 81

Technology Around the World

Networks Olympic net could spell gold for AT&T **17**

Semiconductor Lasers Matsushita's twin-ridge structure boosts power **18**

Communications Industry, government besiege FCC for spectrum slots **19**

Microcomputers Light beams carry data in glass bus **20**

Mass Storage Study says optical-disk market will hit $7.3 billion by 1990 **22**

Local Networks French firm opts for token passing **24**

Holograms Holographic stereogram system speeds automobile designs **30**

Semiconductor Technology Britain getting its SOI technology act together **31**

Automotive Nickel-iron battery powers experimental French car **33**

Medical Diagnostic image transmission gaining acceptance among doctors **34**

Computer Graphics Vendors, users embrace new Graphics Kernel Standard **35**

Strategies Companies salvage profits from manufacturing junkyard **36**

Minicomputers Brazil's computer program takes a sudden outward turn **38**

Telecommunications IBM increases its stake in SBS **44**

Semiconductors Large cell array speeds debut of 32-bit memory manager **44**

People Gert Bindels charts Philips' foray into personal computers. J. Sidney Webb on acquisitions hunt for EMM. James K. George takes charge of zeroing in on chip defects at Motorola **57**

Companies PlessCor, with heavy backers, looking to fiber-optics market. LaPine Technologies has hopes for its role in Winchester business **64**

News Briefs Burroughs and National Semiconductor in 32-bit deal. Laser chip modulated at 2 gigabits/s **24**

contents continued page 4

Participate in our capital expansion program!

Amkor/Anam® has opened a window of opportunity in semiconductor assembly. View these important facts. Utilization of our services, equipment and facilities means you can satisfy your customers' demands . . . increase revenues . . . optimize wafer fab investment . . . increase your market share. And you can accomplish this without making any additional capital investment!

Seize upon a timely opportunity and benefit from our proven integrity, reliability, and on-time performance. Our financial strength, responsive service, new facilities and willingness to invest in state-of-the-art automation means that with Amkor/Anam, capacity will be there when you need it.

Visualize your future needs and participate in our capital expansion program. We are defining tomorrow's opportunities in semiconductor assembly today. Join us now.

Amkor Electronics, Inc.
Valley Forge Corporate Center
901 South Trooper Road
Valley Forge, PA 19403
215-666-9040
Offices in Colorado Springs, CO
Dallas, TX and San Mateo, CA

amkor
anam

TOREN/GAYNOR

Circle 3 on reader service card

VOLUME 57, NO.17 AUGUST 6, 1984

ElectronicsWeek

Special Reports

Local Networks Local nets arrive in force. A market melting pot with an accelerating rate of new entrants seeks the cohesive effect of standards for local networks. But continuing technical advances aiming at network flexibility and lower costs are still the name of the local-net game **67**

Materials Piezo film yields novel transducers. A thin piece of translucent plastic film with unique piezoelectric and pyroelectric properties offers designers a new transducer material with encouraging design possibilities in industrial, medical, and military systems **74**

New Products

Microprocessors 68008 chip gives EXORbus 16-bit power **81**

Artificial Intelligence Four-user AI system runs under Lisp **84**

Terminals Unit mimics VT220, adds enhanced features **88**

Robotics New unit handles dangerous assembly work **90**

Computer Graphics Card lets Q-bus processor create mixed graphics **91**

Components Switches "see" objects moving at 450 ft/min **92**

Microsystems VERSAmodules target CAD, robotics **93**

CAD Terminal takes on adjunct functions to off-load work **94**

IC Equipment New stripper deals with 6-in. wafers **95**

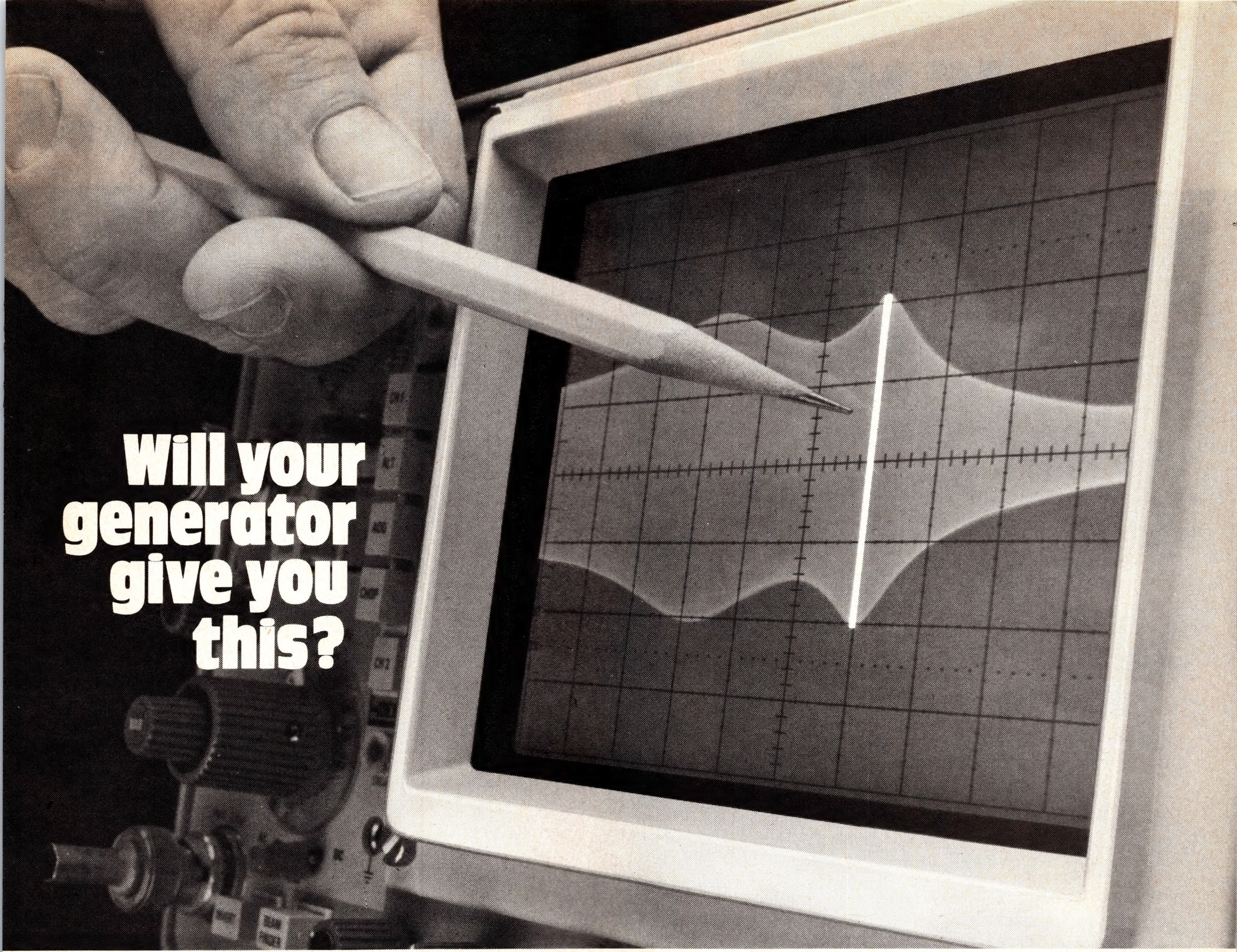
Displays Color monitor boasts resolution of 1,280 by 1,024 **98**

Local Networks Chip set adds Ethernet and Cheapernet **99**

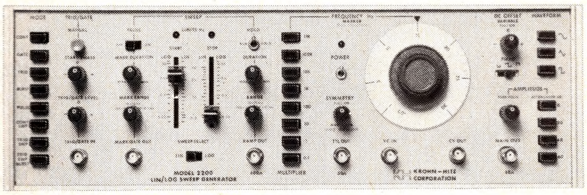
Features

Departments Meetings **12** ElectronicsWeek Index **48**

Washington Insight **52** Materials **100** Letters **102** Editorial **108**



Krohn-Hite's 2200 lin/log sweep function generator with frequency marker will!



Krohn-Hite's new generator delivers more flexibility than any other generator ever offered, including:

- Choice of sine, square, triangle, ramp and pulsed waveforms
- Lin/log sweep, up and down
- Unique frequency marker
- Nine operating modes: continuous, gate, trigger, burst, pulse, sweep, triggered sweep, triggered sweep burst, external VC
- Frequency range .003 Hz to 30 MHz

The exclusive marker/pause feature lets you interrupt the sweep for any duration from 0.1 ms upward, and gives you a bright marker blip at the marked frequency.

These plus numerous other convenience features make the Model 2200 an ideal choice for amplifier gain/response checks, network and filter evaluation, communications equipment testing and many other recurring requirements. Pushbutton operation shortens test time in production operations.

Model 2200 is available today.

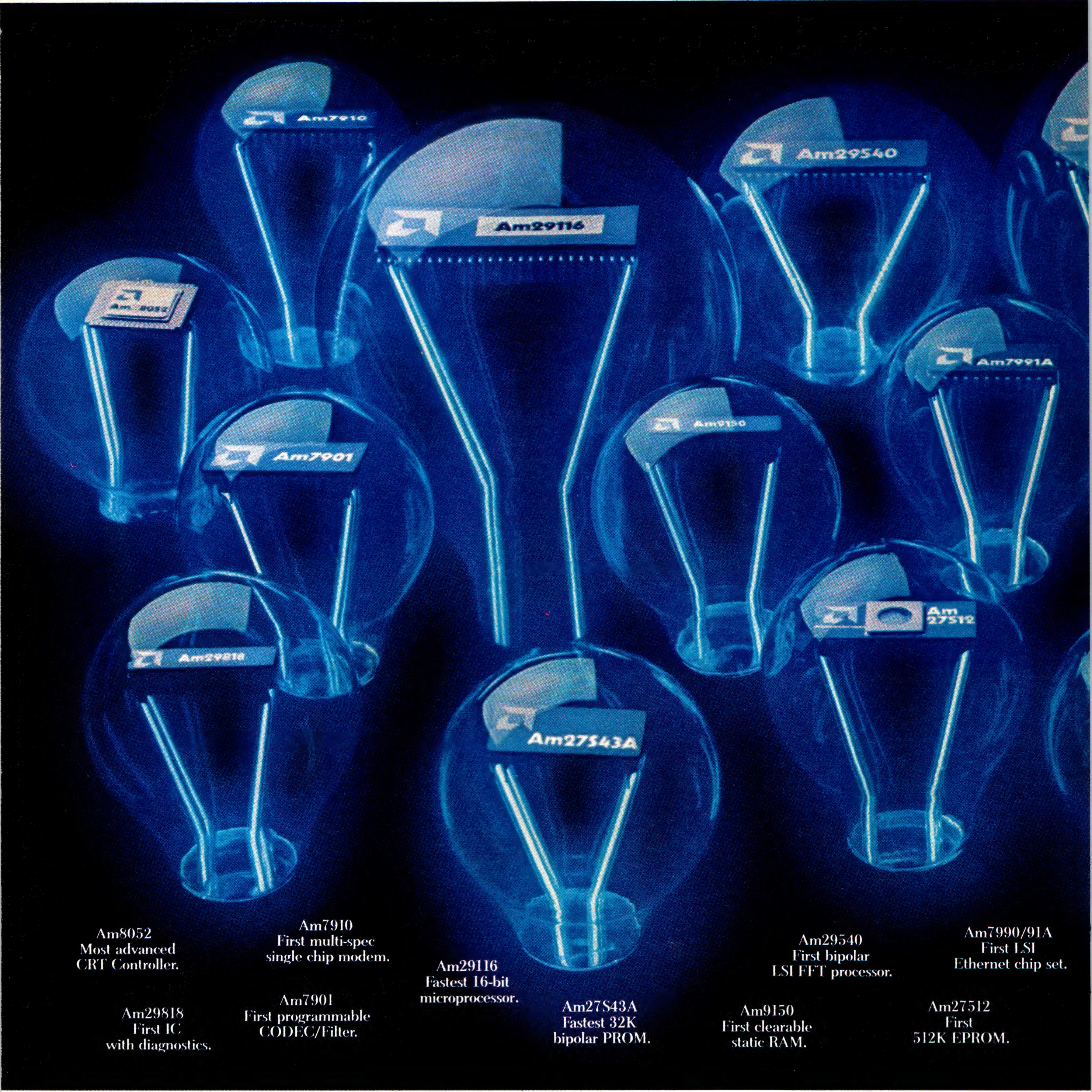
Circle reader service number or contact

KROHN-HITE CORPORATION
Avon Industrial Park, Avon, MA 02322 • (617) 580-1660 TWX 710 345 0831

INTERNATIONAL: ARAB REPUBLIC OF EGYPT, EPIC, 661767; **ARGENTINA,** COASIN, 552-3185; **AUSTRIA,** UNIVERSAL ELEKTRONICK IMPORT, 5415880; **AUSTRALIA,** WARBURTON FRANKI, **Adelaide** 3567333, **Brisbane** (07) 52-7255, **Melbourne** 03 699 4999, **Perth** 657000, **Sydney** 648 1711/648 1381; **BELGIUM,** C.N. ROOD S.A., (02) 735 2135; **CANADA,** WEBSTER INSTRUMENTS LTD., **Mississauga** (416) 625-0600, **Ottawa** (613) 725-1931, **Montreal** (514) 744-5829, **British Columbia** (604) 434-2611, **Alberta** (403) 458-4669; **DENMARK,** SC METRIC A/S, (02) 804200; **ENGLAND,** KEITHLEY INSTRUMENTS, LTD., (0734) 861-287; **FINLAND,** INTO OY, (90) 742-122; **FRANCE,** M. B. ELECTRONIQUE, 956-81-31; **GERMANY,** KEITHLEY INSTRUMENTS LTD. GmbH, (0-89)7-14-40-65; **HOLLAND,** C. N. ROOD B. V., 070-996360; **INDIA,** BALI INTERNATIONAL, 6123046; **ISRAEL,** ARITMOR ENGINEERING CO., LTD., 72 73 17, 72 87 16; **ITALY,** VIANELLO S.P.A., (02) 65.96.171; **JAPAN,** YA-MAN LTD., (03) 667-5945; **NEW ZEALAND,** WARBURTON FRANKI, 664150; **NORWAY,** TELEINSTRUMENT AB., (02) 78-94-60; **PORTUGAL,** MAGNETROM, 57-19-61; **SINGAPORE,** O'CONNOR's (PTE) LTD., 637944; **SOUTH AFRICA,** PROTEA PNI PTY, LTD., (2711) 786-3647; **SPAIN,** C. R. MARES S.A., 257-62-00, 258-09-07; **SWEDEN,** LAGERCRANTZ ELEKTRONK AB., 0760-861-20; **SWITZERLAND,** TECTRON AG., 055-95-1212; **TAIWAN,** ALPHA PRECISION INSTRUMENT CORP., 7013113-5.

Circle 4 on reader service card

IS YOUR CHIP MAKER



Am8052
Most advanced
CRT Controller.

Am7910
First multi-spec
single chip modem.

Am29116
Fastest 16-bit
microprocessor.

Am29540
First bipolar
LSI FFT processor.

Am7990/91A
First LSI
Ethernet chip set.

Am29818
First IC
with diagnostics.

Am7901
First programmable
CODEC/Filter.

Am27S43A
Fastest 32K
bipolar PROM.

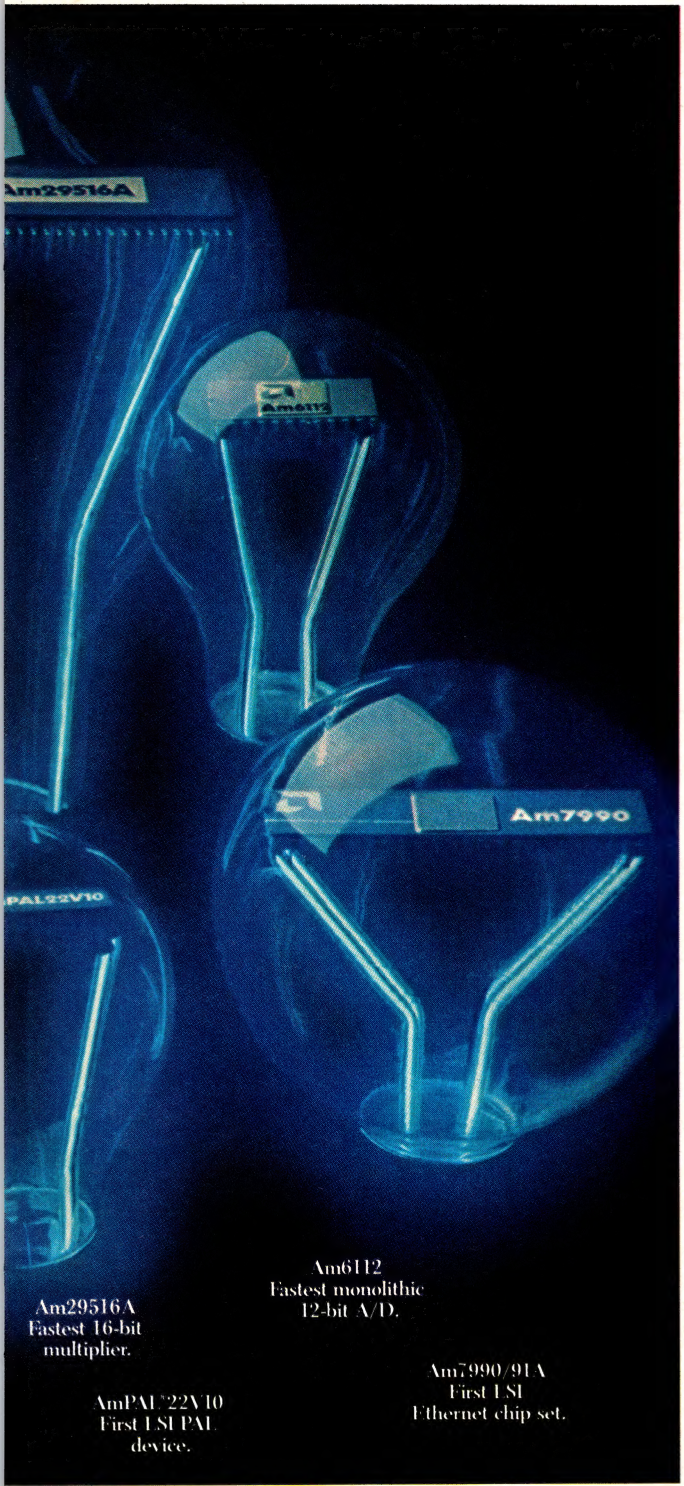
Am9150
First clearable
static RAM.

Am27512
First
512K EPROM.

PAL is a registered trademark of and is used under license from Monolithic Memories, Inc.,
© Advanced Micro Devices 1984.

Advanced Micro Devices • **Bruxelles** (02) 771 99 93 • **Hannover** area (05143) 53 62 • **Hong Kong** (852) 3 695377
London area (04862) 22121 • **Manchester** area (0925) 828008 • **Milano** (02) 339 0541 • **München** (089) 40 19 76
Paris (01) 687.36.66 • **Stockholm** (08) 98 12 35 • **Stuttgart** (0711) 62 33 77 • **Tokyo** (03) 329-2751

AS BRIGHT AS YOU ARE?


Am29516A
Am6112
Am7990
PAL22V10
Am6112 Fastest monolithic 12-bit A/D.
Am29516A Fastest 16-bit multiplier.
Am7990/91A First LSI Ethernet chip set.
AmPAL®22V10 First LSI PAL device.

You're doing everything you can to stay ahead of the competition. Shouldn't your IC company do the same?

We think so.

In 1983 we spent a record-breaking 18.7% of sales on research and development. That's more than any other major IC company.

And that's why 40% of our total sales come from products that were invented here.

Our Am8052 CRT controller lets you squeeze every last drop of performance out of a video tube.

And our Am7910 is the only modem you can program for any major telephone system anywhere in the world.

We make the first perfectly matched VLSI Ethernet chip set and the only complete kit solution to super high speed digital signal processing.

We make the world's first 512K EPROM and the world's fastest microprocessor.

We're even an innovator when it comes to quality.

While other guarantees run on and on, ours is short and sweet.

> The International Standard of Quality guarantees a 0.1% AQL on all electrical parameters, AC and DC, over the entire operating range.
>
> INT·STD·1000

So, if you've got a product you want to really shine, call us. We can put you as far ahead of the competition as we are.

Advanced Micro Devices

For more information, contact the sales agent nearest you or write the word "INNOVATION" on your letterhead and mail it to
Advanced Micro Devices, Mail Operations, P.O. Box 4, Westbury-on-Trym, Bristol BS9 3DS, United Kingdom.

ElectronicsWeek

PREVIEWS

EDITOR IN CHIEF: George R. Davis

EXECUTIVE EDITOR, *technical:* Samuel Weber
EXECUTIVE EDITOR, *news:* Arthur Erikson
MANAGING EDITOR: Howard Wolff

SENIOR EDITORS:
Howard Bierman, Ray Connolly,
Tom Manuel, Kevin Smith, Jeremy Young

ART DIRECTOR: Fred Sklenar

DEPARTMENTS
Business: Robert J. Kozma
Communications & Microwave: Terry Feldt
Components: Ashok Bindra
Computers & Peripherals: Tom Manuel
Government/Military: Ray Connolly
Industrial & Consumer: David M. Weber
New Products: Steve Zollo, Stephen T. Haggerty
Packaging & Production: Jerry Lyman
Semiconductors: Samuel Weber
Software & Microsystems: Jeremy Young
Systems Integration: Robert Rosenberg
Test & Measurement: Howard Bierman

NEWS EDITORS
Robert J. Kozma, Jesse J. Leaf,
David M. Weber

EDITORIAL PRODUCTION
Charles D. Ciatto, *Manager,* June Noto,
Jody LoGrasso, Kevin Powers

COPY DESK
Benjamin A. Mason, *Assistant Managing Editor,* Roger Draper, Bill McIlvaine,
Jim Taibi, Susan Levi Wallach

ART DEPARTMENT
Sachiko Inagaki, *Associate Director*
Annamaria Palma, *Art Assistant*

NEWS BUREAUS
Boston: Craig D. Rose
Chicago: Wesley R. Iversen
Dallas: J. Robert Lineback
Los Angeles: Larry Waller
New York: George Leopold
Palo Alto: Clifford Barney
Washington: Ray Connolly, Karen Berney
Frankfurt: John Gosch
London: Kevin Smith
Paris: Robert T. Gallagher
Tokyo: Charles L. Cohen, Michael Berger

ADMINISTRATIVE ASSISTANT: Kathleen Morgan
EDITORIAL SECRETARIES: Janice Jung,
Josephine Ortiz, Millie Santos

PUBLISHER: Paul W. Reiss

Next ElectronicsWeek

It's clear: video products are going digital

Digital technology has still not lived up to its promise in the television market, but the trend among manufacturers can't be stopped. The next *ElectronicsWeek* cover story, written by David M. Weber, Industrial & Consumer Editor, explores new developments in the video sector and assesses their impact on the industry in the U.S., Europe, and Japan.

How good is high-rel?

When a semiconductor manufacturer performs 100% testing of parts shipped, every outgoing unit is good. That assumption is excessively common and dangerous, warns Eugene R. Hnatek, of Viking Laboratories. In an article for *ElectronicsWeek*, he exposes some myths about high-rel components and details several ways to avoid poor quality.

Looking ahead in ElectronicsWeek

Automated structure analysis gathers speed

Recent developments in automating structure analysis are removing many problems associated with manual applications of the technique. An automated approach lends itself to higher productivity levels in software engineering and may become the principal method for software design in the later part of the 1980s. Norman L. Kerth of Tektronix will write about structure analysis for *ElectronicsWeek*, explaining the technique and its advantages.

Faster, less expensive data conversion is coming

As signal-processing techniques continue to advance, increasing demand for faster and more complex analog-to-digital and digital-to-analog conversion is becoming evident. Will monolithic converters therefore supplant hybrid and modular units? Find out in Components Editor Ashok Bindra's special report, coming soon.

August 6, 1984 Volume 57, Number 17
112,814 copies of this issue printed

ElectronicsWeek (ISSN 0748-3252). Published weekly by McGraw-Hill, Inc. Founder: James H. McGraw 1860-1948. Publication office: 1221 Avenue of the Americas, N. Y., N. Y. 10020; second class postage paid at New York, New York and additional mailing offices. Postage paid at Montreal, P. Q. Registration Number 9034.

Executive, editorial, circulation and advertising addresses: ElectronicsWeek, McGraw-Hill Building, 1221 Avenue of the Americas, New York, N. Y. 10020. Telephone (212) 512-2000. Teletype 12-7960 TWX 710-581-4879. Cable address: MCGRAWHILLNEWYORK.

Subscriptions limited to professional persons with active responsibility in electronics technology. No subscriptions accepted without complete identification of subscriber name, title or job function, company or organization, and product manufactured or services performed. Based on information supplied, the publisher reserves the right to reject nonqualified requests. Subscription rates: the United States and possessions $32 one year, $55 two years, $76 three years; company addressed and company libraries $40 one year, $67 two years, $93 three years; Canada and Mexico $34 one year, $57 two years, $78 three years; Europe $50 one year, $85 two years, $125 three years; Japan, Israel and Brazil $85 one year, $140 two years, $200 three years; Australia and New Zealand $95 one year, $170 two years, $240 three years, including air freight; all other countries $50 one year, $85 two years, $125 three years. Limited quota of subscriptions available at higher-than-basic rate for persons allied to field served. Check with publisher for these rates. Single copies: $3.00. Please allow four to eight weeks for shipment.

Officers of McGraw-Hill Publications Company: President: John G. Wrede; Executive Vice Presidents: Paul F. McPherson, Operations; Walter D. Serwatka, Finance & Services. Senior Vice President-Editorial: Ralph R. Schulz. Senior Vice President Publishers: Harry L. Brown, David J.McGrath, James R. Pierce, Gene W. Simpson, John E. Slater. Vice President Publishers: Charlton H. Calhoun III, Richard H. Larsen, John W. Patten. Vice Presidents: Kemp Anderson, Business Systems Development; Shel F. Asen, Manufacturing; John A. Bunyan, Electronic Information Services; George R. Elsinger, Circulation; Michael K. Hehir, Controller; Eric B. Herr, Planning & Development; H. John Sweger Jr., Marketing; Virginia I. Williamson, Business Development.

Officers of the Corporation: Harold W. McGraw, Jr., Chairman; Joseph L. Dionne, President and Chief Executive Officer; Robert N. Landes, Senior Vice President and Secretary; Ralph J. Webb, Treasurer.

Title registered in U. S. Patent Office; Copyright 1984 by McGraw-Hill, Inc. All rights reserved. The contents of this publication may not be reproduced in whole or in part without the consent of copyright owner.

Where necessary, permission is granted by the copyright owner for libraries and others registered with the Copyright Clearance Center (CCC), 21 Congress Street, Salem, Mass. 01970, to photocopy any article herein for the base fee of $0.50 per copy of the article plus $0.25 per page. Payment should be sent directly to the CCC. Copying done for other than personal or internal reference use without the express permission of McGraw-Hill is prohibited. Requests for special permission or bulk orders should be addressed to the publisher. ISSN 0748-3252/84$0.50+.25.

Subscribers: The publisher, upon written request to our New York office from any subscriber, agrees to refund that part of the subscription price applying to copies not yet mailed. Please send change-of-address notices or complaints to Fulfillment Manager; subscription orders to Circulation Manager, ElectronicsWeek, at address below. Change-of-address notices should provide old as well as new address, including zip codes. Attach address label from recent issue. Allow one month for change to become effective. Subscriber Service: call (201) 356-7980, 9 a.m. to 4 p.m. EST. Postmaster: Please send Address Changes to Fulfillment Manager, ElectronicsWeek, CN 808, Martinsville, N. J. 08836.

Editorial department phones: Administration (212) 512-2645, News and New Products (212) 512-2685, Technology (212) 512-2666. **Business departments:** (212) 512-3469 (a full listing of Business departments follows the Advertisers' Index).

SIEMENS

The Energy-Saving Computer

Heating costs are high. So far, analog heating control systems reacting to outside temperature changes, have been used to save energy. But only the microcomputer has answered the call for greater economy and simplified construction together with high performance capability.
It therefore permits significant improvements in such heating control systems.

A new development from Siemens – the single-chip microcomputer SAB 80215 – with its integrated, application-oriented peripheral features provides the performance demanded:

- highly sensitive control system
- maximum operating convenience
- temperature control individually programmable for every day of the week
- timer
- protection of timer and all input data in case of power failure
- measurement and display of different temperatures
- sensor monitoring for line breaks or short circuits
- alarm signal in case of incorrect operation.

The Siemens single-chip microcomputer SAB 80215 is equipped with the extended 8021 processor (2-Kbyte ROM, 128-byte RAM) and integrated peripheral units, such as:

- A/D converter and counter
- clock with stop function and alarm call
- keyboard inquiry, display control and
- closed-circuit operation.

This makes a lot of other applications possible. For further details simply write to Siemens AG, Infoservice/B 8304-101, Postfach 156, D-8510 Fürth, quoting "SAB 80215".

Single-chip microcomputer SAB 80215 from Siemens

B 8304.101

Circle 130 on reader service card

ElectronicsWeek is important to him... I'm sure it's important to me.

Ever notice how some people always seem to have the right answer? No matter what the situation, they always seem to be a step ahead.

And they're successful ... the first in line to lead an important project...the first in line for a promotion. It's certainly not magic. Usually it's a combination of hard work, brains, guts and desire.

It probably means they read ElectronicsWeek... regularly.

ElectronicsWeek has helped propel many a manager and engineer to the front line... to the "leading edge" of the industry. And just as we've been providing many of your colleagues with the right information, the important information—when they need it most—so too can we provide it for you.

Every week an ElectronicsWeek subscriber receives an issue crammed with the latest information on new products, developments, concerns and trends in the worldwide electronics industry.

When you become a subscriber, we'll supply you with the intelligence you need to make the big decision, or the every day decision to further your career and reap profits for your company. For a taste, just browse through the issue you're holding.

But, you really don't have to believe us. Just ask the person who's always a step ahead.

To become a subscriber, just complete and mail the insert card in this magazine. If subscription card is missing, write: Circulation Manager, ElectronicsWeek, P.O. Box 511, Hightstown, N.J. 08520.

ElectronicsWeek

The Voice of the industry

YOU OWE IT TO YOURSELF TO CHOOSE FROM THE BEST.

Choosing the right logic analyzer can be tough. But one thing is clear—you want all the advantages you know you can count on from the performance leaders.

EVEN AMONG THE LEADERS, THE DIFFERENCES CAN BE SIGNIFICANT.

For example, not all the top logic analyzers give you 200 MHz timing. Or highly sophisticated linkage and interactive analysis. Or 1000-word deep data collection and auxiliary memories. Or an easy-to-use ASCII keyboard. Or floppy disk data storage. *Only Nicolet's 800 series gives you all these advantages.* In the end, though, it's Nicolet's unmatched price/performance ratio that's the most important difference.

SOME LOGIC ANALYSIS SYSTEMS GROW WITH YOUR NEEDS. SOME DON'T.

Only Nicolet makes it easy and inexpensive to enhance *performance*—not just add channels—any time you need it. And the NPC-800 Series gives you *five* instruments to choose from starting at $7950, and more options than anyone else in the industry: Waveform Recorder, Performance Analysis, CT/SA, Computer/IEEE-488 Controller, Printer Software, Non-Volatile Memory, Dot Matrix Printer, and Second Disk Drive.

PUT THE LEADERS TO THE TEST.

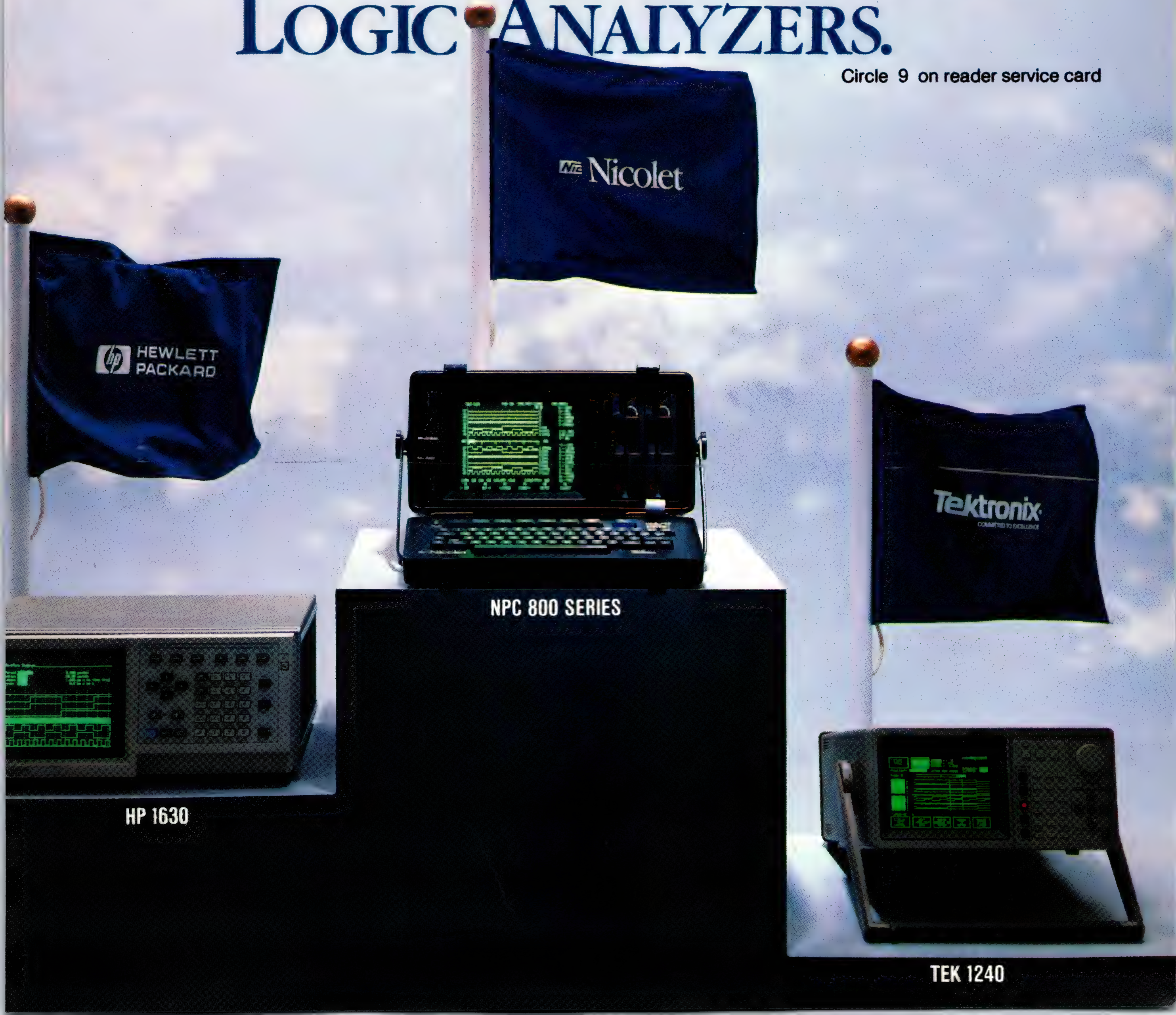
When you really think about it, the only way to be sure is to let the best logic analyzers prove what they can do—for *you*. When it comes to capability, versatility, and performance, there's really only one choice. For a Logic Analyzer Comparison Chart, call: **(800) NICOLET** or **(415) 490-8300** (inside CA). Nicolet Paratronics Corporation, 201 Fourier Ave., Fremont, CA 94539.

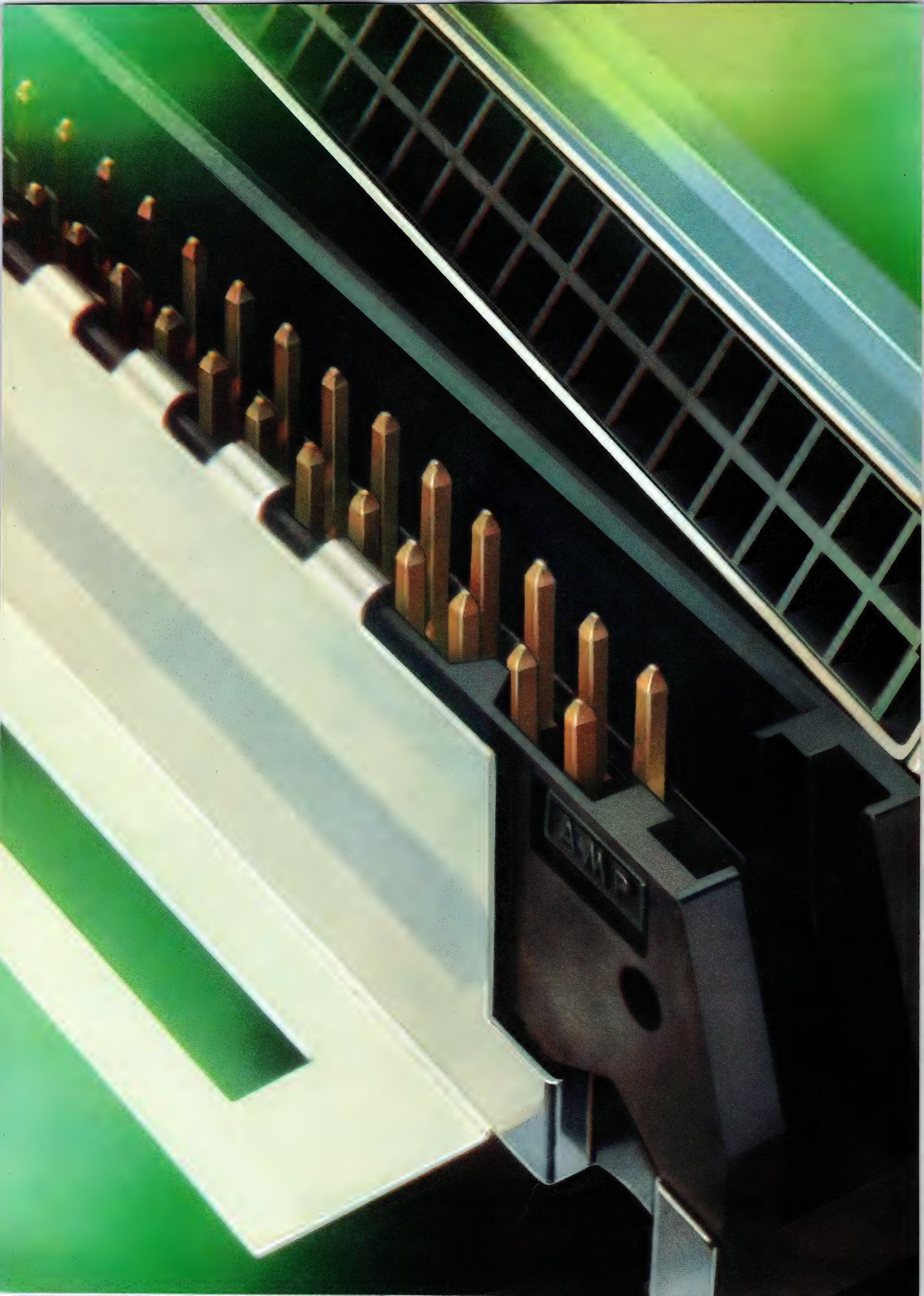
Think of us!

Nicolet

THE WORLD'S THREE GREAT LOGIC ANALYZERS.

Circle 9 on reader service card




AMP

AMP shielded ribbon cable connectors.

EMC retrofit, without board redesign.

Now designers facing FCC Docket 20780 requirements have two ways to go.

Redesign your pc boards to accommodate shielded headers.

Or keep your present board design and headers, and use AMP shielded ribbon cable connectors.

On the board, a one-piece metal shield snaps onto the universal header you're using. At the cable, a specially-sized AMP-LATCH connector with metal shell crimps to the cable shield. No soldering is required.

And the cable half fits the board half perfectly.

AMP has other shielding solutions, too, including shielded subminiature Ds (that fit existing metal-shell headers) and even a shielded feed-through assembly for ribbon cable passing through a panel cutout.

All ways to help you turn redesign time into new-design time.

All ways to get you back to the business of productivity.

From AMP.

For complete details, call the AMP-LATCH Information Desk at (717) 780-4400. AMP Incorporated, Harrisburg, PA 17105.

CIRCLE NUMBER 125

AMP means productivity.

hielded AMP- LATCH onnectors

Full 360° termination, multiple point-piercing contacts suitable for foil and mesh type shields.

Snap-on plastic cover provides strain relief.

Subminiature D Connectors

- Mates with existing metal-body subminiature D headers.
- Metal shield fits over standard AMP subminiature D cable connector.

Standard AMP-LATCH Connectors

- Styles, shapes and configurations to fill any need.

AMP and AMP-LATCH are trademarks of AMP incorporated.

25 WATTS RF POWER 1-500 MHZ.

NEW, ALL SOLID STATE AMPLIFIER WORKS INTO ANY LOAD IMPEDANCE.

The 525LA is an extraordinarily versatile source of power that will find wide application in virtually all RF labs. Covering the frequency range of 1 to 500 MHz, with a flat 50 dB of gain, the 525LA is driven to its full Class A linear output by any signal or sweep generator.

Like all ENI amplifiers, the 525LA features unconditional stability, absolute protection from overloads, and it will work into any load impedance. So if you need a rugged source of RF power for RFI/EMI, RF transmission, component testing, NMR or transmitter design, the 525LA amplifier could just be the most useful tool in your laboratory.

For more information, or a full-line catalog, contact **ENI**, 3000 Winton Road South, Rochester, NY 14623. Call 716/473-6900, or telex 97-8283 ENI ROC.

ENI

The advanced design line of RF power amplifiers.

Meetings

14th International Symposium and Exhibition on Industrial Robots, Society of Manufacturing Engineers (Patricia Van Doren, RE/SME, 1 SME Drive, P.O. Box 950, Dearborn, Mich. 48121), Gothenburg, Sweden, Oct. 1-5.

iAPX 86, 88, 186 Microprocessors Workshop, Intel Corp. (27 Industrial Ave., Chelmsford, Mass. 10824-3688) Intel Training Center, Chelmsford, Mass., Oct. 1-5.

Copimera 84, Mechanical and Electrical Engineer's Association of Buenos Aires (David R. Reyes-Guerra, c/o ABET, 345 E. 47th St., New York, N.Y. 10017), Centro Cultural San Martin, Buenos Aires, Argentina, Oct. 1-5.

Sixth International Symposium on Subscriber Loops and Services, Société des Electriciens, des Electroniciens et des Radioélectriciens, the French section of the IEEE *et al.* (Solange Le Brun, SEE, 48, rue de la Procession, 75724 Paris, France CEDEX 15), Nice, France, Oct. 1-5.

Symposium on Optical Fiber Measurements, National Bureau of Standards, IEEE, and Optical Society of America (Collier Smith, U.S. Department of Commerce, NBS, Washington, D.C. 20234), Boulder, Colo., Oct. 2-3.

Gidep Workshop, Government-Industry Data Exchange Program (Gidep Operations Center, Corona, Calif. 91720), Sheraton Hotel, Spokane, Wash., Oct. 2-4.

Pecora IX Remote Sensing Symposium, IEEE *et al.* (William L. Alford, Code 933, NASA/GSFC, Greenbelt, Md. 20771), Howard Johnson Convention Center, Sioux Falls, S.D., Oct. 2-4.

Automatic Testing and Test Instrumentation 84, Network Events Ltd. (Network Events Ltd., Printers Mews, Market Hill, Buckingham, MK181JK, England), Palais des Congres, Paris, France, Oct. 2-4.

Sixth Electrical OverStress/ElectroStatic Discharge Symposium, IIT Research Institute and EOS/ESD Association (Stephen Halperin & Associates, P.O. Box 1225, Elmhurst, Ill. 60126), Marriott Hotel, Philadelphia, Pa., Oct 2-4.

16th International Information Management Congress—Informatics 84, IMC and Micrographics Society of Singapore (IMC Informatics 84, P.O. Box 34404, Bethesda, Md. 20817), Hyatt Regency Hotel, Singapore, Oct. 2-4.

Third QualTest Conference and Exposition, Society of Manufacturing Engineers *et al.* (Public Relations, SME, 1 SME Drive, P.O. Box 930, Dearborn, Mich. 48121), Cincinnati Convention/Exposition Center, Cincinnati, Ohio, Oct. 2-4.

Northcon/84 and Mini/Micro Northwest-84, IEEE (Electronic Conventions Inc., 8110 Airport Blvd., Los Angeles, Calif. 90045), Seattle Center Coliseum, Seattle, Oct. 2-4.

27th Biennial International Electrical, Electronics Conference and Exposition, Canadian Region IEEE (The Hilda Wilson Group, 20 Eglinton Ave. East, Suite 203, Toronto, Ontario M4P 1A9), Metro Toronto Convention Centre, Oct. 7-9.

National Conference on the Advancement of Research, National Research Council (Chester McKee, Office of Scientific & Engineering Personnel, National Research Council, 2101 Constitution Ave., N.W., Washington, D.C. 20418), Colonial Williamsburg, Va., Oct. 7-10.

International Conference on Computer Design, IEEE (Albert E. Ruehli, IBM Corp., Thomas J. Watson Jr. Research Center, P.O. Box 218, Yorktown Heights, N.Y. 10598), Rye Town Hilton, Port Chester, N.Y., Oct. 7-11.

60th Fall Conference, Electronic Industries Association (Mark V. Rosenker, EIA, 2001 Eye St., N.W., Washington, D.C. 20006), Los Angeles, Oct. 8-11.

For the manager who is serious about improving product quality and lowering production costs...

HP introduces the Q-STAR network

Move into the age of computer integrated manufacturing with HP board test systems and HP's exclusive Q-STAR network.

Q-STAR (Quality Systems for Test, Analysis and Repair) is an integrated approach to solving your manufacturing test problems when your requirements call for more than just a test system. Analysis of the test data provides information you can use to solve your manufacturing process problems.

With the HP 3065 Board Test System, you can test your complex analog/digital PC boards. HP's Q-STAR network gives you detailed process data to help fine tune your entire manufacturing and assembly process. You can use this information to smooth out your production process as well as greatly increase your product quality. Use Q-STAR to identify chronically bad parts and subassemblies. Search out the weaknesses in the build procedure. Minimize product rework. Control production costs and boost product quality by maintaining tighter, more informed control of the production cycle.

In addition, HP paperless repair software provides automation of your repair process, speeds the repair and provides insight into what actually happened, permitting rapid identification of subtle manufacturing process problems.

Improving Product Quality.

With HP's Q-STATS and paperless repair software (part of the overall Q-STAR system), you can get management, utilization and process yield reports to help you reduce inventory and improve your process. To provide a total solution to your testing problems, HP offers this capability as a standard no-charge feature of the HP 3065 Board Test System. Plus, by taking advantage of Q-STAR's compatibility with HP's much larger Manufacturer's Productivity Network (MPN), you have a powerful set of tools for increasing product quality.

Lowering Production Costs.

The HP 3065 Board Test System provides the highest throughput possible today. That means your test backlogs become significantly reduced. Get your new products into production faster with the new HP CAD-VANTAGE software. A vital component of the HP Q-STAR network, this software automatically links any CAD database to an HP 3065, freeing you from laborious manual entry of board topology. Once your CAD data is transferred, HP's advanced IPG-II test program generation package lets your engineers produce efficient test code. For greater responsiveness to increasing production schedules, each HP 3065 controller can support up to six configurations including three test heads, six development and repair stations, or a combination of your choice.

With the HP Q-STAR network, you can improve product quality while lowering production costs.

Hewlett-Packard provides a complete line of board test systems, featuring a wide selection of capabilities and prices to satisfy most production test applications. To find out more, contact your local HP field office listed in the telephone directory white pages. Ask for the electronic instruments department.

HEWLETT PACKARD

Circle 13 on reader service card

PRESENTING VAXSTATION 100. A COMPREHENSIVE TOOL FOR THE TECHNICAL PROFESSIONAL.

While others have been busy designing computing systems for the technically naive, Digital has been busy designing them for the technically astute.

The welcomed result: the VAXstation 100™ workstation terminal. Connected to a VAX™ host computer by fiber optic cable, VAXstation 100s make full use of the VAX/VMS™ operating system, its layered products and the range of its office automation, networking and applications software.

The VAXstation 100 workstation terminal: graphics processor, monitor, keyboard and mouse.

The workstation terminal's comprehensive design demands that you now reconsider what is possible with computer assistance. From filling polygons to filing reports, it enables you to automate every step of a technical project. Whether in engineering, education, research, or science. Whether your need is text manipulation, numerical calculation, graphics processing – or all three.

To be sure, the VAXstation 100 workstation terminal will be the envy of every technical professional who now sits before a computer dedicated to doing one or two things well at the expense of doing anything else.

THE FRIENDLIEST INTERFACE IN TECHNICAL CIRCLES.

The VAXstation 100 workstation terminal mirrors the latest trends in desktop computing with a complete assortment of end-user niceties. They include all-English commands, helpful pop-up menus, descriptive icons and convenient pointing devices.

Powerful screen management software presents the user with an endless array of overlapping applications windows and the means to move easily between them.

With this friendly interface you can simultaneously display and interrelate any combination of tasks. You can work with equal facility in words, numbers, or pictures. You can work concurrently on parts of different jobs. Or on different parts of the same job.

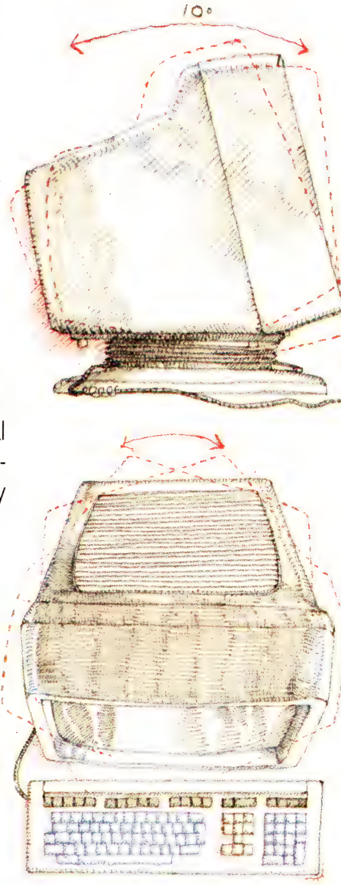
Each application window remains active whether on display or not. Like papers on a desk, windows can be moved at will, allowing you to always maintain a "clean" working environment.

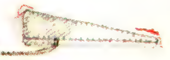
DRAWING ON THE POWER AND VERSATILITY OF VAXSYSTEMS.

The VAXstation 100 workstation terminal can be added to any existing UNIBUS™ VAX computer, from the 11/725 to the 11/785.

This makes VAXstation 100 the most versatile add-on workstation of its kind. It capitalizes on your installed base of software by executing the thousands of programs written by Digital and third parties for the VT100™ terminal series, as well as those applications written for the popular Tektronix 4014™ terminal. And in almost every case, it executes them without modification.

While scaled-down subsystems compromise the performance of micro-based workstations, the VAXstation 100 presents no such barriers. With virtual memory management, your program size is defined by the virtual address space of the VAX computer – some two billion bytes. You also get the complete set of VMS operating system facilities and utilities that have made it a world-famous development environment.





Plus, there's a wide choice of high-level languages important to technical professionals, including industry-standard versions of FORTRAN and Pascal and artificial intelligence languages like VAX LISP.

No matter what you're working on, or how demanding your project is, the VAXstation 100 workstation terminal possesses an astonishing capacity to work right along with you.

Your working surface is a crisp nineteen-inch monochrome raster display. The screen boasts 864 x 1088 pixel resolution. The monitor tilts and swivels to suit your environment and your posture.

At your disposal is both the CORE Graphics Library (based on the CORE graphics standard) and the VAXstation Subroutine Library. Both are callable from a high-level language, and between them you are guaranteed full creative freedom throughout the design and simulation phases.

A powerful MC68000™ microprocessor running at 10MHz has been completely dedicated to screen management and graphics processing. Its accelerator enhances raster operations. This allows you to move large pixel blocks quickly and slide windows across the screen without erasing them. You can even process multiple applications on the screen simultaneously.

Whether you are working on circuit design, seismographic studies, CAD/CAM, or financial

© Digital Equipment Corporation, 1984. Digital, the Digital logo, UNIBUS, VAXstation 100, VAX, VMS, and VT100, are trademarks of Digital Equipment Corporation. 4014 is a trademark of Tektronix, Inc. MC68000 is a trademark of Motorola, Inc.

modeling, whether you are executing familiar technical tasks or dabbling on the edge of engineering exotica, you'll run out of practically everything before you run out of VAX software.

MAINSTREAMING THE TECHNICAL PROFESSIONAL.

VAXstation 100 workstation terminals can be configured with ease. Whether you network them via Ethernet throughout a hierarchy of VAX/VMS systems, or cluster several around a single processor, communications remain streamlined. Each station can access the full range of VAX information management and office automation tools. In this way, the data and programs in general company use can be incorporated into technical projects. Conversely, the highly technical results in a single applications window can be mainstreamed throughout the corporation.

VAXstation 100 workstation terminals let you and your coworkers share and swap information readily. Extrapolate results quickly. Draw conclusions confidently. They rescue the technical professional from tiresome commuting between single-function workstations. They declare war on errors and lost time attributable to manual conversions.

This is the state-of-the-art in distributed computing. VAXstation 100s will not just help project managers increase productivity some day – they will do so immediately.

DIGITAL'S COMMITMENT TO THE WORKSTATION MARKET.

The first add-on workstation terminal for VAX systems, the VAXstation 100 is also the first in a family of new workstation products from Digital. Each reflects Digital's dedication to providing integrated computing solutions.

The workstation terminal provides a truly comprehensive and cost-effective way to coordinate the work of engineers, scientists and researchers. It is unmatched in its ability to accommodate the fluid and unpredictable nature of highly technical projects. And it does so elegantly, whether in response to a momentous change in direction or to a momentary change of heart.

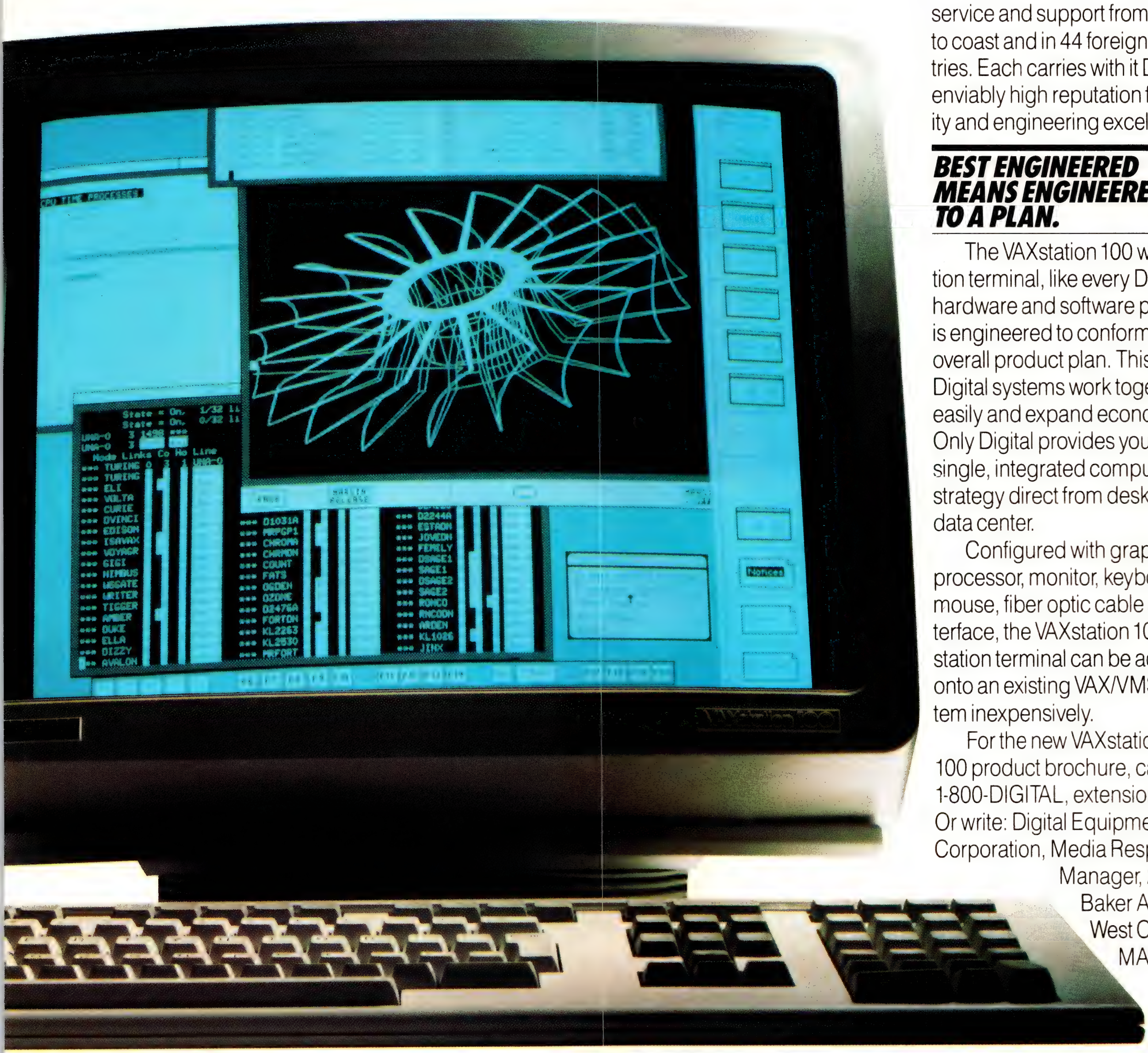
Each VAXstation 100 system comes backed by full Digital service and support from coast to coast and in 44 foreign countries. Each carries with it Digital's enviably high reputation for quality and engineering excellence.

BEST ENGINEERED MEANS ENGINEERED TO A PLAN.

The VAXstation 100 workstation terminal, like every Digital hardware and software product, is engineered to conform to an overall product plan. This means Digital systems work together easily and expand economically. Only Digital provides you with a single, integrated computing strategy direct from desktop to data center.

Configured with graphics processor, monitor, keyboard, mouse, fiber optic cable and interface, the VAXstation 100 workstation terminal can be added onto an existing VAX/VMS system inexpensively.

For the new VAXstation 100 product brochure, call 1-800-DIGITAL, extension 250. Or write: Digital Equipment Corporation, Media Response Manager, 200 Baker Avenue, West Concord, MA 01742.



THE BEST ENGINEERED COMPUTERS IN THE WORLD.

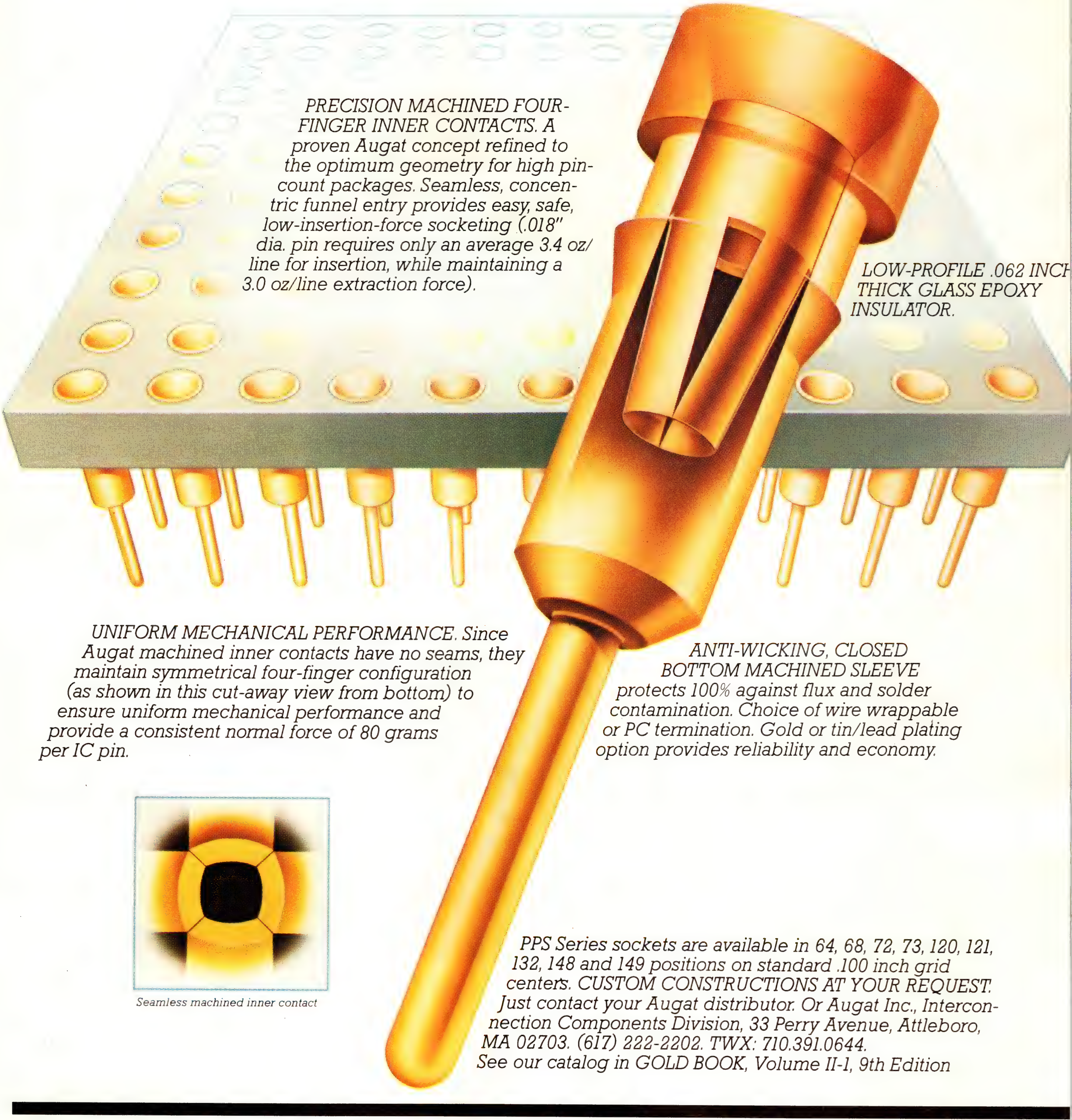
digital™

Circle 15 on reader service card

AUGAT GIVES PIN GRID ARRAY SOCKETS A LIF.

Augat engineering just took the pressure off socketing pin gri arrays. With new PPS Series Low Insertion Force sockets.

Engineered to provide important wiping action while protecting ICs from damage, the PPS Series reduces insertion force by more than 50% compared with conventional pin grid array sockets utilizing stamped and formed inner contacts.



PRECISION MACHINED FOUR-FINGER INNER CONTACTS. A proven Augat concept refined to the optimum geometry for high pin-count packages. Seamless, concentric funnel entry provides easy, safe, low-insertion-force socketing (.018" dia. pin requires only an average 3.4 oz/line for insertion, while maintaining a 3.0 oz/line extraction force).

LOW-PROFILE .062 INC THICK GLASS EPOXY INSULATOR.

UNIFORM MECHANICAL PERFORMANCE. Since Augat machined inner contacts have no seams, they maintain symmetrical four-finger configuration (as shown in this cut-away view from bottom) to ensure uniform mechanical performance and provide a consistent normal force of 80 grams per IC pin.

ANTI-WICKING, CLOSED BOTTOM MACHINED SLEEVE protects 100% against flux and solder contamination. Choice of wire wrappable or PC termination. Gold or tin/lead plating option provides reliability and economy.

Seamless machined inner contact

PPS Series sockets are available in 64, 68, 72, 73, 120, 121, 132, 148 and 149 positions on standard .100 inch grid centers. CUSTOM CONSTRUCTIONS AT YOUR REQUEST. Just contact your Augat distributor. Or Augat Inc., Interconnection Components Division, 33 Perry Avenue, Attleboro, MA 02703. (617) 222-2202. TWX: 710.391.0644. See our catalog in GOLD BOOK, Volume II-1, 9th Edition

AUGAT® *Quality and Innovation*

AROUND THE WORLD

AT&T STRIVES FOR GOLD AT OLYMPICS

Linking 50,000 users on a network the size of Southern California proves costly, but may pay off in a big way for AT&T ☐ *by Larry Waller*

Los Angeles

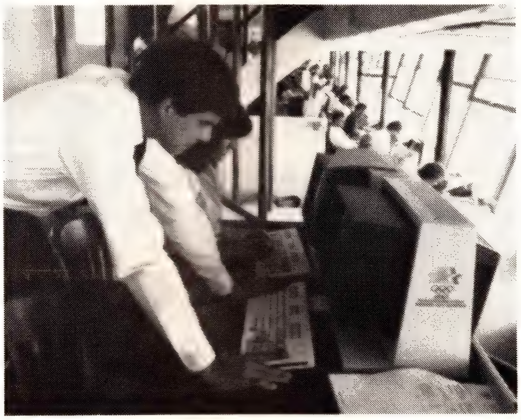
There may be no better place to showcase a new information-management and communications system than the 1984 Summer Olympic Games, which are being viewed by a worldwide audience of upwards of 2 billion. But in the glare of such a world spotlight, it had better perform perfectly.

That fact weighed heavily on AT&T Co.'s corporate mind when, as the official telecommunications sponsor of the Games, it began putting together its network in early 1983—a network that would link some 50,000 users scattered over a 4,500-mile^2 area of Southern California. Early reports after the Games began were that the system was more than meeting expectations, say AT&T executives. What's more, the system could be a peek at the company's future direction.

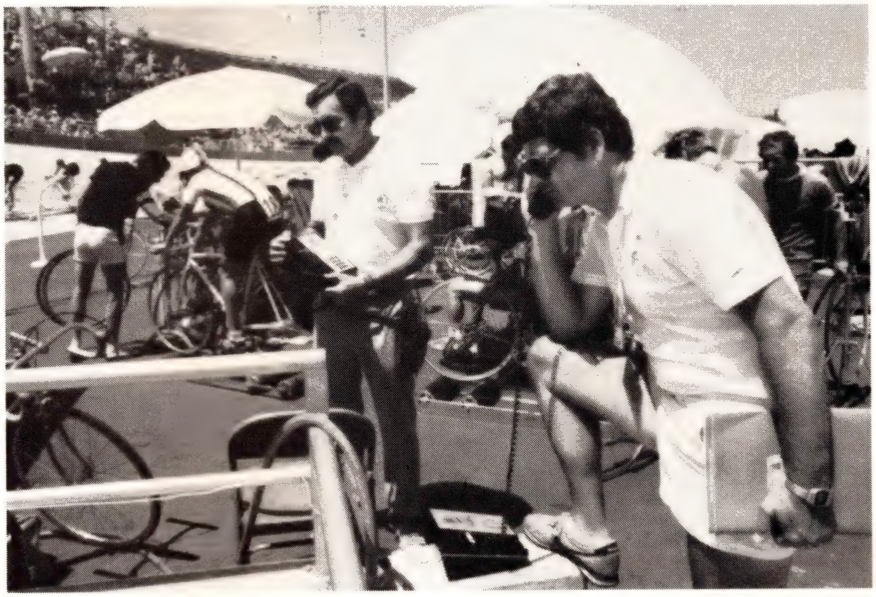
The task handed AT&T by the Los Angeles Olympics Organizing Committee, with its goal of financing the Games through the private sector and showing a profit, was unprecedented in its scope: linking by electronic messaging and voice a total of 28 sports sites, three Olympic villages, broadcast and press centers, and numerous administrative and support locations. The equipment entirely replaces the customary messengers and telephones, a seemingly impossible task since in some cases the sites are 200 miles apart.

The equipment's importance cannot be overstated, say LAOOC officials. In fact, some have dubbed AT&T's Electronic Messaging System (EMS) the central nervous system of the Olympics, because it carries the data vital to the minute-by-minute operation of events. It allows all participants—athletes, coaches, officials, and the media—to access, share, or transmit information.

The system's key access points are some 2,000 AT&T Teletype 5410 12-in. terminals, which are linked by a 10-Mb/s fiber-optic local network, along with 14 of AT&T's biggest minicomputers, the 3B20S Unix System V. Another 500 Teletype printers are also part of the system. Although these hardware elements already existed, "the trick was to package them into a turnkey system," ex-



Instant info. At the 1984 Summer Olympic Games in Los Angeles, AT&T's user-friendly electronic messaging system provides event results, athlete profiles, electronic mail, and a host of other features.



Electronic camera gets workout at Olympics

One Olympics event that won't make the record books is the test that Canon Inc. is making of an electronic still camera that conforms to recently announced international standards [*Electronics,* July 12, 1984, p. 64]. The prototype developed by the Tokyo camera manufacturer features a charge-coupled-device color sensor with 780 by 490 pixels, produced by Texas Instruments Inc., Dallas.

Canon will send photos taken by the camera to Japan over transpacific voice-grade telephone lines. Displayed on a monitor, the images serve as instant "contact sheets" for selection of shots for delivery later. If the results are encouraging, Canon expects to be able to offer a product for professional applications sometime next year. The company will not divulge what kind of price such a camera would carry.

Canon could leapfrog Sony Corp., which showed the first experimental electronic still camera with much fanfare three years ago [*Electronics,* Sept. 8, 1981, p. 76]. Sony has been working with the Japanese newspaper *Asahi Shimbun* to develop a black-and-white camera for news photos, but it probably won't be used at the Olympics. Sony's camera also conforms to the recently announced standards, albeit a subset of them. **–Charles L. Cohen**

plains George S. Snow, AT&T manager of new systems planning and implementation.

Moreover, the software to make it operate had to be written virtually from scratch, a job undertaken in February 1983 by an AT&T Bell Laboratories team. If there is any part of the AT&T network that breaks new ground technologically, it is the software designed for the electronic messaging, points out Snow.

Intended to be used by those with no technical background and only 10 minutes' instruction, the software works through a menu of information and service options displayed on the screen and run by pressing a single key.

Journalists transmit stories through the terminals, which also provide results within minutes of the events being completed. Other features of the system include radio paging with a 40-character message display, and, for Olympic officials, person-to-person electronic mail.

Future standard. AT&T's Snow singles out the messaging software as "setting a new user-friendly standard for the human side of communications, one that we want to pursue further." The system's voice-communication portion, developed for the Games, is one of the largest temporary telephone networks ever installed, the company claims, and consists of some 7,000 special telephones and more than 20 private branch exchange units.

The price of AT&T's admission into the Olympics was not low: $15 million—$9 million of it for hardware, about $3 million for the special software, and the remainder to integrate it, according to a company source. But the communications giant senses a payoff that could make that outlay look reasonable. ☐

SEMICONDUCTOR LASERS

Matsushita's twin-ridge structure lifts laser power; etched mirrors integrate lasers into ICs

Takatsuki, Japan—Semiconductor lasers, although expensive and limited in their power output, already have managed to win a place in leading-edge equipment such as fiber-optics transmission systems and optical disk players. Now these tiny lasers could well start turning up in all sorts of new applications, thanks to two new technologies worked out at Matsushita Electronics Corp.'s semiconductor laboratory at Takatsuki.

One of the new technologies makes for much higher output power: the Takatsuki researchers have made experimental gallium-aluminum-arsenide chips with outputs of 200 mW at 830 nm. By next year, Matsushita Electronics, a subsidiary of Matsushita Electrical Industrial Co. of Osaka, expects to sell chips with an output of 50 mW; this is sufficient to reliably erase many kinds of optical disks, an application with vast potential.

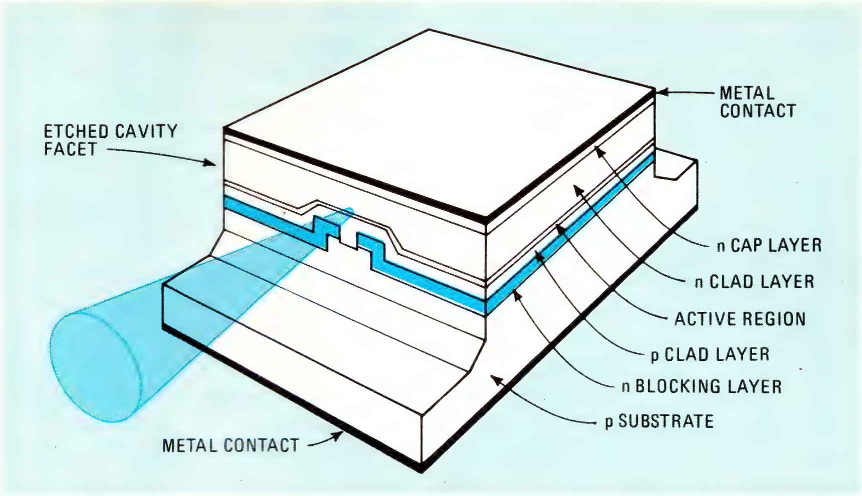
The other new technology offers a way to etch laser cavity mirrors into wafers, which makes it possible to design integrated circuits that incorporate lasers. Moreover, it will cut fabrication and testing costs for discrete devices because coating and testing can be done to whole wafers rather than to individual chips.

Key to the high output power is a laser structure that puts an n-GaAs blocking layer on the p-GaAs substrate side of the active layer. Matsushita calls the design a buried twin-ridge substrate (see figure).

The structure confines current flow to the narrow strip of the active layer in which lasing takes place. In addition, it facilitates evanescence of the laser beam into the clad layers on either side of the active layer, which helps keep beam density low enough for long life even at high power levels.

The blocking layer on the substrate blocks current flow except at the gap—6 to 7 μm wide—between the twin ridges in the layer. The double heterostructure grown over the blocking layer consists of three layers of GaAlAs, with the middle active layer only 0.03 μm thick.

The percentage of aluminum in the three layers is selected so that the two outer layers have a lower



Confining. Buried twin ridges in the blocking layer confine current flow to the narrow strip of the active layer where lasing occurs. This increases both power and the life of the laser.

index of refraction and act as the clad layers of an optical waveguide. Surprisingly, the liquid epitaxial growth process used to fabricate these chips fills in the gap between the ridges selectively, so that the lower clad layer is thick in the gap (but thin elsewhere) and has a flat surface on the top.

Thick and thin. The combination of a thin active layer, current confined to the narrow strip of active region overlying the gap, and a thick clad layer only under that strip, produce the desired characteristics. The active layer's thinness causes the beam to evanesce into the clad layers, and beam depth is greater than for a thicker active layer.

The gap between the ridges, and thus the width of thicker portion of the lower clad layer, determines the beam's width. Beam cross-section is relatively large—typically, an ellipse 1.3 μm deep by 6 to 7 μm wide.

Lasing action takes place in an optical cavity formed by cleaving the ends of the laser perpendicular to the substrate. For maximum output, the lasers are fabricated with a four-layer thin-film coating on their rear cavity surface to increase reflectivity to 96%. This reduces losses from backward emission. The front surface has a single-film coating to reduce reflectivity to only 4% for increased forward emission.

Reduced optical losses and confinement of current to a narrow strip of the active layer make for low threshold current and high efficiency. Threshold current is typically 60 mA, and external quantum efficiency can exceed 60%.

Refinements. In addition to devising a new structure that boosts power output, Matsushita's engineers at Takatsuki refined the conventional method for fabricating lasers. Rather than cleaving high-reflectivity polished mirror facets perpendicular to the substrate, they etch them. Laser diodes made by this process have threshold currents as low as 28 mA and outputs of 10 mW at about 800 nm, with an external quantum efficiency of about 27%. These characteristics are appropriate for lasers used in compact disk players.

Many laboratories have tried to make short-wavelength lasers with etched cavities but have failed. Matsushita found the way by studying the inclination angles in multilayer GaAlAs structures for different ratios of aluminum. Then they were able to determine the ratios needed for vertical walls. –**Charles L. Cohen**

COMMUNICATIONS

Industry, government besiege FCC for slots in reserved spectrum

Washington, D.C.—The Federal Communications Commission has reached an impasse over the allocation of 41 MHz of reserved spectrum. Whatever solution it manages to come up with will, to an uncommon degree, shape the mix of communications technologies and services for years to come.

No fewer than eight separate interests are vying for choice chunks of the 806-to-947-MHz band at the commission's disposal. A draft allocation decision set for late July was withdrawn at the last minute from the agency's agenda because of unresolved internal conflicts. Now, FCC chairman Mark Fowler is putting the heat on his bureau chiefs to forge a compromise by the year's end.

The competing parties, their claims, and FCC supporters are:

- TV broadcasters wanting 4 MHz of space for studio transmission links. They are represented by the Mass Media Bureau.
- Cellular-telephone operators seeking at least 12 MHz for future expansion in metropolitan areas and represented by the Common Carrier Bureau.
- Private land-mobile-radio interests crying for an immediate 32 MHz of paired spectrum, plus General Electric Co. demanding 8 MHz to supply a short-distance personal radio service. Both are represented by the Private Radio Bureau.
- Mobile Satellite Corp., of Philadelphia, requesting 8 MHz, and Skylink Corp., of Boulder, Colo., requesting 4 MHz, to launch and operate a satellite-based mobile-phone system for rural residential and business customers [*Electronics,* April 5, 1984, p. 52]. Airfone Inc., Oakbrook, Ill., wants 4 MHz to operate both an air-to-ground and a railway telephone system in a joint venture with Amtrak. These two proposals have gotten the most sympathy from the FCC's Office of Science and Technology.
- The U.S. government, represented by the National Technical Information Agency, seeks 6 MHz for point-to-point terrestrial communications.
- The Electronic Industries Associa-

tion, fighting on its own in a petition for 4 MHz for cordless phones.

In the past, the commission analyzed requests on the basis of technical and economic sense, and its decisions were cut and dried. But this time, "we don't have as much flexibility," explains Alex Felker, an electronics engineer in the Office of Plans and Policies.

Being clever. There are many unknowns. The satellite mobile phone and air-to-ground telephone systems, for instance, are promising technologically but more difficult to justify from the users' perspective when compared with other services that have already proven their usefulness. So, Felker says, the FCC must be "much more clever about the way it makes decisions."

Being clever means coming up with novel ways to share the spectrum. As an example, Mal Murray, an electronics engineer in the Office of Science and Technology, cites an experiment under which Airfone is sharing the 899-to-901- and 944-to-946-MHz bands with signals from TV broadcasters.

Basically, this is possible because the paths of their transmissions as well as the shape and focus of their signals are different. Airfone also says the same principle holds for railway phones as long as the base stations for each service are located far enough apart to minimize co-channel interference.

Frequencies could also be shared on a geographical basis, suggests Felker, as is being done between UHF TV and land-mobile operators. A strong possibility is NTIA and other point-to-point microwave users, such as oil companies.

Picking losers. But spectrum sharing has its limits. "At best, sharing can only reduce the problem but it can't solve it," observes William Adler, deputy chief of the Common Carrier Bureau. "No matter how you slice it, there isn't going to be enough spectrum to accommodate everyone. In the end, there will have to be some losers," he says, pointing to FCC trends as a guideline.

Increasingly, the commission gives priority to petitioners that are using spectrum-conservation techniques but still face a shortage. The land-mobile radio community could intensify its use of its existing 100 MHz by implementing narrowband technologies, such as digital modulation. Similarly, spread-spectrum modulation might be used for cordless telephones. Also, mobile satellites might be eligible for spectrum sharing with cellular services if their design included multiple spot-beam antennas.

The FCC is unlikely to mandate the adoption of a specific technology. It is more likely to impose "incentive structures" that produce the same result. In the case of land-mobile operators, a new spectrum might be held in reserve with its future allocation contingent upon their gradual phasing in of more bandwidth-conserving technologies.

The losers are bound to be those that can be pushed to frequencies above 1 GHz. The satellite mobile-phone and airphone operators are the likely choices. **–Karen Berney**

MICROCOMPUTERS

Light beams carry data in glass bus

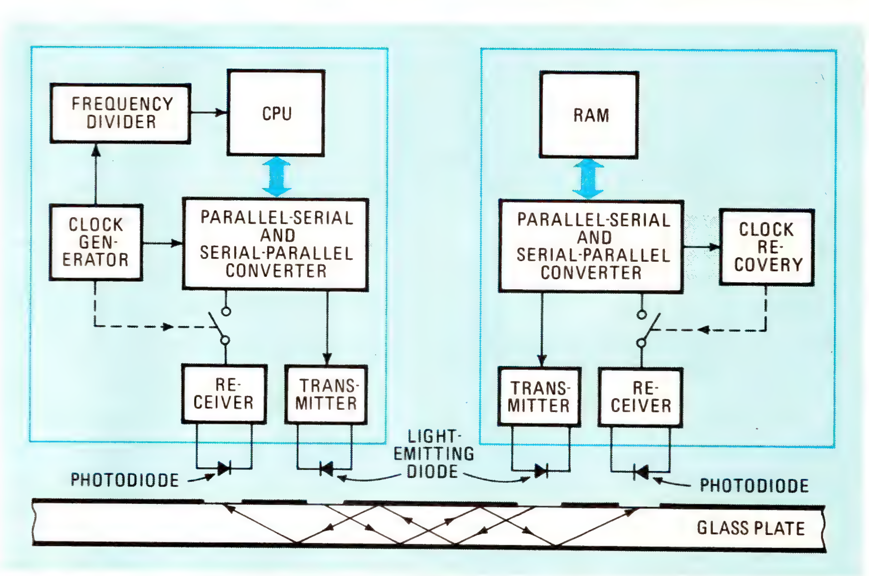
Duisburg, West Germany—Already staggering, the number of bits that must be shifted between a microcomputer's central processor, its memory, and its peripheral integrated circuits is ever on the increase. Looking ahead to the time when the volume will outstrip the capabilities of conventional copper-wire buses, a research team at the University of Duisburg has devised an optical bus in which data signals flow through a metal-clad glass plate, not along lines on a printed-circuit board.

Through a window. In the new breed of bus, optical signals emanating from a light-emitting diode at one microcomputer subsystem are transmitted throughout the glass plate and are picked up through a small coupling window in the metal cover by a photodiode at another subsystem. Data transmission is serial, so the correct sending and receiving devices can be clocked onto the bus at the same time.

Given optimized photodiodes and LEDs, data rates as high as 2 gigabits/s should be feasible, predicts Klaus-Rüdiger Hase, who heads the development team at the university's Department of Communications Technology. He bases his prediction on the synchronous bus his team developed for a microcomputer built around a Rockwell International 6502 microprocessor.

The data rate achieved is 72 Mb/s, Hase says. The new optobus should help eliminate a bottleneck that experts predict will soon plague microcomputer technology: the limited data-transport rate of conventional electrical parallel bus systems. These limits will get worse as microcomputer parts speed up.

To be sure, the bottleneck in the



Light bus. The glass-plate optobus has two sorts of serial-parallel/parallel-serial data converters: a clock generator for the CPU (left) and a clock recovery for RAMs and peripherals.

IEEE-488

One of the purest signals your radios will ever receive.

The Fluke 6071A Signal Generator

Leading mobile radio manufacturers worldwide have selected the Fluke 6071A as their preferred synthesized signal generator.

Why?

As a critical element in RF tests systems, the 6071A meets their demands for receiver testing to 1040 MHz.

How?

Its –140 dBm to +13 dBm output is strong enough to reach the upper limits required for distortion tests, and pure and quiet enough to easily make multi-order intermodulation, adjacent channel rejection, and other off-channel measurements. Spurious ouput levels are on the order of –90 dBc to –100 dBc, while the typical broadband noise floor is –150 dBc/Hz. Plus the 6071A offers built-in AM, FM, ØM, and IEEE-488 compatibility!

The 6071A is backed by Fluke's 20 years of experience in RF technology. And it's available at a price that's half of what you might expect to pay for equivalent performance.

Picture the 6071A in your RF test system. Then to find out how to get it there give us a call at **1-800-426-0361** or contact your local Fluke Sales Engineer or Representative. You'll prefer the 6071A too. Pure and simple.

IN THE U.S. AND NON-EUROPEAN COUNTRIES:
John Fluke Mfg. Co., Inc.
P.O. C9090, M/S 250C
Everett, WA 98206
(206) 356-5400, Tlx: 152662

IN EUROPE:
Fluke (Holland) B.V.
P.O. Box 5053, 5004 EB
Tilburg, The Netherlands
(013) 673973, Tlx: 52237

FLUKE®

Copyright © 1984, John Fluke Mfg. Co., Inc. All rights reserved. Ad No. 6112-6070 For technical data circle number 103 data rate can be eased by widening the data-bus word length, but that calls for a more complex contact scheme. With its many pins, larger sockets, and, hence, greater use of such materials as gold, copper, and tin, such a scheme would eventually cost more than the microsystem's chips themselves.

A way out of this dilemma is the Duisburg optobus. In essence, it consists of a glass plate, typically 2 mm thick, whose surfaces have been coated with a 0.5-μm boundary layer of silver or aluminum. The double mirror so formed, which need be only of pocket-mirror quality, has a 5-μm copper layer on both of its surfaces for stability.

On the side on which the microcomputer subsystems are mounted, windows are etched into the boundary and copper layers. Optical signals from an LED are coupled through its window into the glass and decoupled from the glass through the photodiode's window. For an LED, the window is only about 1 mm in diameter. For a photodiode, however, the window is much larger—roughly 2.5 by 2.5 mm—in order to ensure that there is enough light to generate a high photocurrent.

Plenty of conversion. Because up-to-date microcomputers handle data in parallel, Hase and his team have designed parallel-serial/serial-parallel converters for microcomputer parts, such as central processing units, as well as for such peripheral parts as random-access memories. The converters for the CPU and similar logic parts control all transfer operations in the bus system and work with the central clock generator. The converters for the peripherals, on the other hand, operate with a clock recovery circuit to ensure synchronized data transmission.

Excepting the clock generator and recovery circuits, all components—the converters as well as the receiving and transmitting signal amplifiers for the LEDs and photodiodes—are almost identical. It takes about 200 gates to implement a parallel-serial/serial-parallel converter. Power reaches all parts through strips in the copper layer.

Besides the high data-transfer rate, the optobus boasts other advantages over conventional bus systems that are based on pc boards. For one thing, since the optobus does without a complex interconnection system using tin, gold, and other high-quality materials—its base material is only glass—it cuts costs considerably.

Except for the supply lines in the copper layer, there are no electrical conductors outside the ICs, so interference from external electromagnetic fields is much reduced. This reduction enhances microcomputer reliability in rough environments, such as those that can be found in industrial plants. **–John Gosch**

MASS STORAGE

Exhaustive study predicts market for optical disks will spurt from near-zero now to $7.3 billion by 1990

Santa Barbara, Calif.—Few would challenge the proposition that optical disk drives are a can't-miss product soon to become an important computer storage medium. But predicting what will happen in such a fledgling market—and when—taxes even those seers who specialize in the data field.

Accordingly, it took consultant Freeman Associates Inc. nine months to produce its voluminous forecast, said to be the first comprehensive report on optical data storage for sale on the open market.

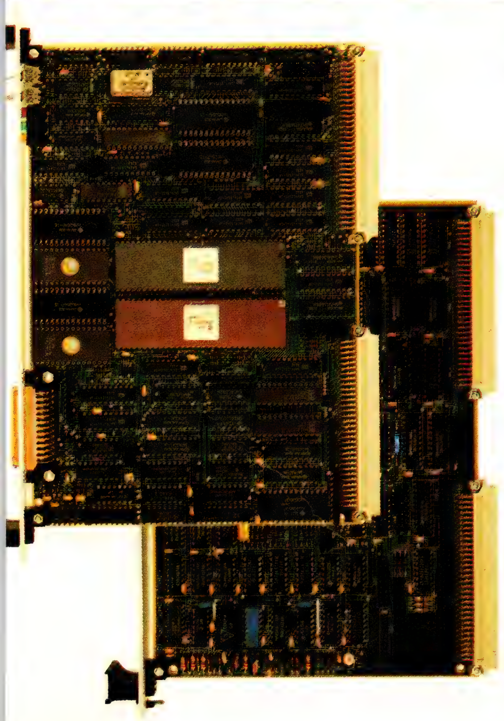
The major finding of the 295-page document, say authors Raymond C. Freeman Jr., president of the Santa Barbara consultancy, and Donald C. Collier, its vice president, is how fast the optical disks will make their mark. It predicts sales of $7.3 billion by 1990, from a 1984 base of nearly zero. Fueling the boom on the supply side is the worldwide research commitment in lasers, media, optics systems, and drives—"untold millions of dollars from upwards of 40 companies," notes Freeman.

As for demand, users have a need for a storage device that fills the gap between magnetic disks and magnetic tape, he says (see "Redefining 'low': 1 gigabyte for an optical disk," left). Its advantages: much lower cost per byte than magnetic disks plus faster access than tape. In volume quantities, this cost edge works out to $10/megabyte for optical disks, against $40 for magnetic disks and

Redefining 'low': 1 gigabyte for an optical disk

To analyze the optical disk market, Freeman Associates subdivided it into three product groups, each with a separate focus. At the low end, drives for microcomputers have capacities starting at 1 gigabyte, expanding to 1.5 gigabytes, and access times running less than 200 ms. At midrange are drives from 1.5 gigabytes to 3 gigabytes and with 100-to-200-ms access times. (As yet, no drive entries have been announced in this class, in comparison with the upper and lower levels.) High-end drives have capacities above 3 gigabytes and access times under 100 ms. The drives in all three categories so far are read-only, or write-once in the optical disk vocabulary.

Some basic elements of an optical disk differ from those of a magnetic drive. Among them: a laser source and the read/write spot-forming optics. Like magnetic drives, the new competitors for mass-storage applications have servo-controlled positioners, data-channel encoding and decoding, error-control circuitry, and the disk and drive mechanism proper. **–Larry Waller**



FORCE WINS BY TKO

IN OUR CORNER: MASS MEMORY INTERFACE BOARDS

Intelligent SASI interface
SYS68K/SASI-1

- On-board 68000 local processor
- On-board 68450 DMA controller
- 4 free programmable DMA channels
- 16K bytes dual ported RAM
- 16K bytes handling firmware

Direct Winchester/Floppy Controller
SYS68K/WFC-1

- Direct control of up to 3 Winchester drive
- Direct control of up to 4 Floppy drives
- Automatic formatting of hard disks
- Speed up to 5M bit/sec
- Supports single/double sided, double density floppy disks.

Other FORCE products of the SYS68K VMEbus family:

- 3 powerful CPU's
- Dynamic RAM boards up to 2MB
- Static RAM boards
- Analog I/O boards
- 6 channel serial I/O board
- Power Supply and Backplanes
- High resolution color graphics subsystem
- Integrated configurations
- Powerful operating software
- OPIO-1 32 Bit Opto Isolated with DMAC

For further information please contact one of our distributors or representatives or FORCE Computers direct, the VMEbus specialist.

FORCE COMPUTERS®

FORCE COMPUTERS INC.
2041 Mission College Blvd.
Santa Clara, California 95054
Phone (408) 988-8686
TLX 172465
FAX (408) 980-9331

FORCE COMPUTERS GmbH
Daimlerstraße 9
D-8012 Ottobrunn/München
Telefon (0 89) 6 09 20 33
Telex 5 24 190 forc-d
Telefax (0 89) 6 09 77 93

$50 for tape. For access times, the optical units at 250 ms rank in the middle of 50 ms for disk and 10 s for tape.

Probably the most controversial finding in the report is Freeman's contention that the inability to delete and alter data on the optical disk is not a major impediment to market penetration. In fact, he makes a case that nonerasability is a positive, not a negative.

Drawbacks. While the Freeman report, which sells for $1,650, paints a bright outlook for the new product, it by no means skips the negative factors. Heading this list is limited supply, with only nine announced manufacturers to date selling nonstandard formats. Further, there is the need for converting software, a massive task, and inculcating what amounts to a new storage "hierarchy/culture."

Also, because of the ever-present need for suppliers to look over their shoulders at IBM Corp., there is hesitancy until the computer giant makes its plans known. The Armonk, N.Y., firm is believed to have three separate developments underway, based on 5¼-, 8- and 14-in. disks, according to the report.

Though the report is still too hot off the press to generate much feedback, Freeman says one major firm already has told him unofficially that his conclusions track their own internal studies closely. That is heartening confirmation, underlining his conviction that optical disks' technological time has come.–**Larry Waller**

News Briefs

Burroughs, National form 32-bit team

Burroughs Corp. and National Semiconductor Corp. broke new ground last month in relations between chip and computer makers when Burroughs became the first major computer maker to publicly adopt NSC's 32000 microprocessor family. The two also got together for the first cooperative effort between a major systems original-equipment manufacturer and a large semiconductor company on major software development: a joint venture to create enhanced versions of AT&T's Unix System V, Release 2 operating system for the 32000. Burroughs, in fact, opted for the 32000 family rather than Motorola Inc.'s 68000 line largely because of the NSC chip's Unix benchmark performance, according to a Burroughs official. Another consideration was the compatibility of the instruction set among various processors in the 32000 line. Burroughs already has started to develop an advanced distributed-processing system based on the 32-bit chip line at its Advanced Systems Group laboratories in Boulder, Colo., and San Diego and plans commercial introduction for late 1985 or early 1986. The system will feature a proprietary local network and a Unix-based operating system tuned to distributed applications.

Single-chip laser modulated at 2 Gb/s

Experimental versions of a long-wavelength laser with two field-effect transistors that can modulate the laser at 2 gigabits/s integrated on the same chip have been fabricated at NEC Corp.'s Optoelectronics Research Laboratories. The initial goal is to produce chips for local networks and two-way community-access TV, with future use in long-distance telephone circuits. Output of the double heterostructure lasers, which nestle on a 300-by-600-μm chip, is several milliwatts at 1.3 μm. Long-wavelength lasers are attractive because their 1.3 μm-light emission suffers minmum dispersion in quartz optical fibers.

NTT recruits U.S. disk-drive makers

Nippon Telegraph & Telephone Public Corp. is looking for two U.S. companies to do research and development work on large-capacity magnetic disk storage systems. The Japanese company plans to purchase two prototype systems—one from each firm—in June 1986 and approximately 200 spindles a year thereafter. The call for applications is part of a well-publicized effort to assuage criticism that Japan freezes out foreign suppliers of equipment for its public sector. Inroads by non-Japanese firms, however, have so far been modest. In fiscal 1983, NTT purchased about $140 million of U.S. equipment.

General Motors to buy stake in vision companies

With its eye on speeding the development of machine vision systems for factory application, General Motors Corp. announced plans last week to purchase an equity position in three vision-equipment suppliers. The giantautomaker will buy up to 20% each of Automatix Inc., Billerica, Mass., and View Engineering Inc., Simi Valley, Calif. Its General Motors of Canada Ltd. unit will purchase up to 30% of Diffracto Ltd., Windsor, Ont., subject to Canadian government approval. GM also agreed to fund cooperative research and development projects with the firms.

RCA, Racal ink international procurement pact

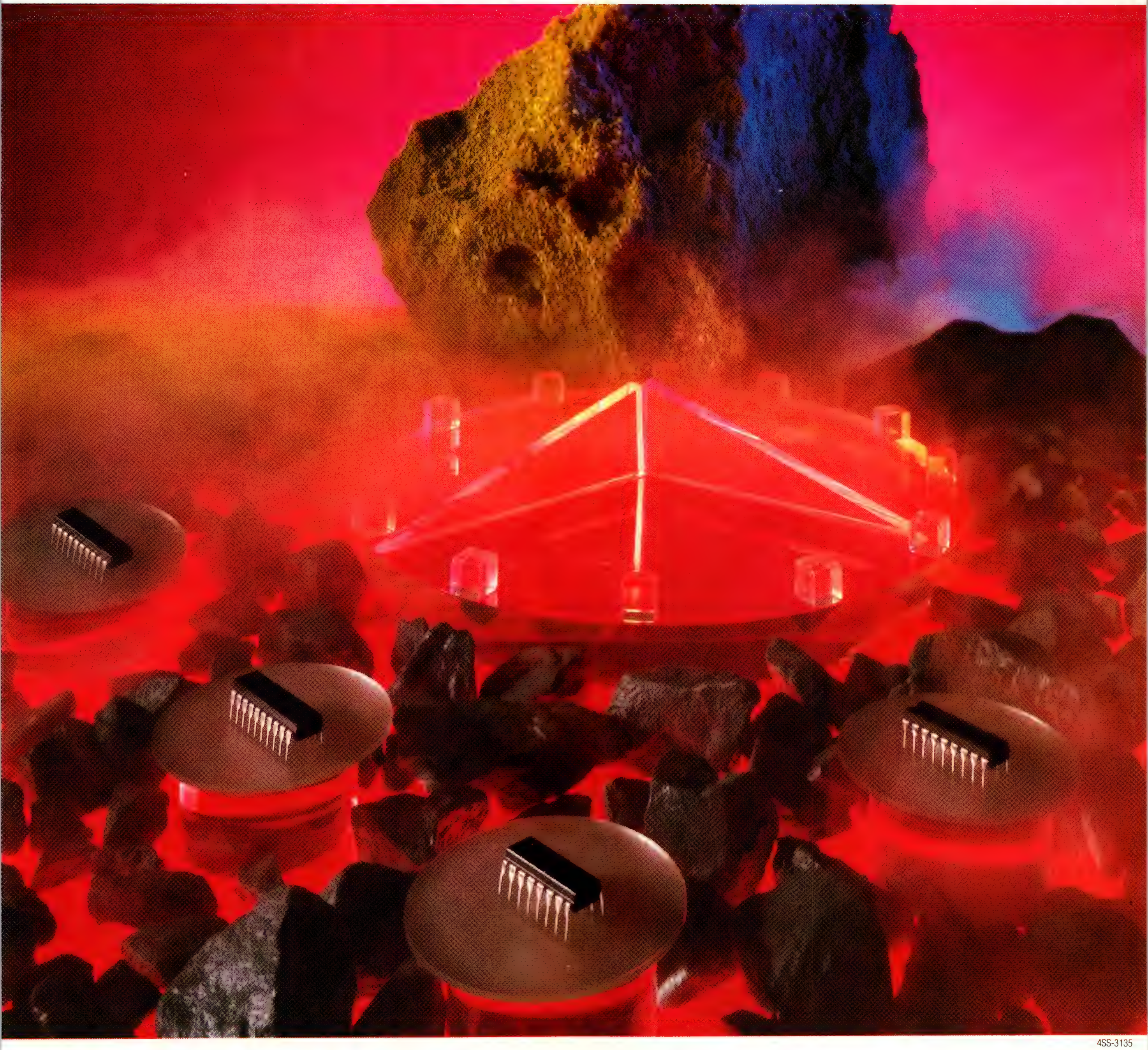
In an effort to reap benefits from their economies of scale, 15 associated companies of Racal Electronics Ltd., Bracknell, Berkshire, England, have banded together and signed a contract to buy over $2 million in components from RCA Corp.'s Solid State Division. An RCA representative labels the one-year pact, which involves four Racal companies in the U.S. and 11 in the U.K., "the first international procurement agreement for RCA components." Covered under it are RCA integrated circuits, microprocessors, and logic circuits, says the representative. Racal is pursuing similar international agreements with other components manufacturers, a spokesman says, and "not just in semiconductors."

LOCAL NETWORKS

French firm opts for token passing

Paris—The recently nationalized Compagnie Générale des Constructions Téléphoniques is about to take what looks like a giant step toward establishing itself in the office automation field. Just out of development and ready to go to market from its subsidiary Laboratoire Central de Télécommunications is a remarkably flexible local network based on token

RELIABILITY.



4SS-3135

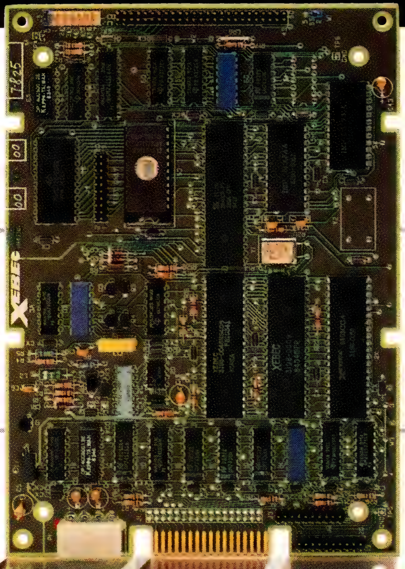
SPRAGUE DOCUMENTS IT FOR MANY ICs.

Users can now forecast failure rate as a function of junction temperature for many popular Sprague ICs. Sprague's accelerated life test program has been documented in two reliability reports. Accelerated testing generates the failures necessary to provide the data for obtaining the reliability projections. Reports on the Series ULN-2000A and ULN-2800A Darlington Drivers and Series UDN-6100A High-Voltage Display Drivers contain actual data from reverse-bias testing at high temperatures. While other manufacturers may be reluctant to provide such information, this data (Engineering Bulletins 29304.6 and 29313.2) can be obtained from the Technical Literature Service, Sprague Electric Co., a Penn Central unit, 35 Marshall Street, North Adams, Mass. 01247. For additional assistance, call William Sullivan at 617/853-5000.

SPRAGUE
THE MARK OF RELIABILITY

Circle 25 on reader service card

There Are Only Two Pla
Solutions Outshine
Inside Micros.



Xebec has always had the inside track on better storage peripherals for microcomputers, thanks to the technological expertise gained over the past decade in the world of minicomputers and "top-downed" into the fast-moving world of microcomputer storage.

It has consistently been our ability to build on strength that has kept Xebec an industry leader. Our ability to define specific storage problems. To design solutions with superior features. And, in almost miraculous timeframes, to *deliver* on those solutions, so OEMs could get to market with better, more competitive microcomputer systems before the market got away from them.

Today, Xebec sells more disk controllers for micros than anyone. Custom controllers. And off-the-shelf controllers for all the best-known standard drives. For 5¼-inch Winchesters. For 3½-inch Winchesters. For half-heights. For floppy/fixed and fixed/removable combinations.

And we sell them to more companies making micros. Small ones. And larger ones like IBM. ITT. Toshiba. Texas Instruments. And ICL.

Testing In Twos. Another Inside Story.

One of the most significant storage problems faced by OEMs is how to pair a zero-defect Xebec controller with a disk drive that often cannot measure up to that standard and won't match up when interfaced.

Our solution? A Xebec tested pairs program that tests and matches drives and controllers with Xebec-designed test equipment under rigorous Xebec-defined standards. You save time and money on evaluation engineering and incoming inspection, and get a single-source, single purchase order solution that you know will work. Available now in a range of drive capacities and configurations, Xebec tested pairs may be just the right combination inside your system.

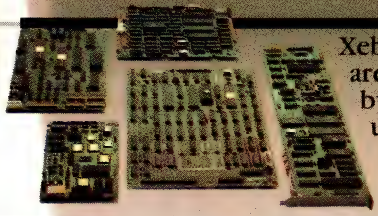
Now For The Outside Story.

While Xebec's high-performance controllers and quality-matched tested pairs are smart solutions inside many of today's microcomputer packages, customers are also finding that our storage packages are just as smart—and smart-looking, too—on the outside of their systems.

CORPORATE HEADQUARTERS
2055 Gateway Place, Suite 600
San Jose, California 95110 U.S.A.
(408) 287-2700

ces Where Xebec Storage The Competition.

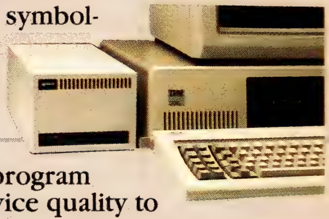
And Outside.



Xebec storage subsystems are now being purchased by OEMs and large-volume end users. These systems, with their attractive but unobtrusive desktop design, also tell a classy inside story. It's a story featuring the quality matching of the finest components—controllers, disk drives and power supplies.

And the choices are impressive: the high reliability 10-megabyte 9710 subsystem, or the high-performance 30-megabyte 9730T with integral tape backup, to the handsome "bookend" 10-megabyte 9710H.

The Cost Of Quality.
The Price Of Leadership.



Xebec's quality proposition, symbolized by our "Xero D" signature, is simple: *You don't pay for mistakes you don't make.* To back up that promise, we've built a company-wide zero-defect program that brings product and service quality to new levels of excellence. For you, that means products in high volume at consistently higher levels of quality—at a total cost of ownership significantly less than products delivering significantly less—which we think is a price you won't mind paying.

We've managed to pay off on our quality and deliverability claims because we've paid the price of leadership. We've invested in the best people, facilities and equipment available. The latest robotics equipment. The finest CAD/CAM facilities. The smartest automated assembly and test fixtures. We have made that forward-looking investment with a sharp eye on the future of the microcomputer industry. A future—and an industry—in which we'll continue to be a leader.

Call Xebec now. Have a Xebec representative give you the inside and outside story on your right storage solution.

Xero D.

XEBEC
The Zero Defect Company

SALES, INTERNATIONAL,
Belgium
32-02-762-9494
TWX: 65054 Xebec B
England
44-628-71138
TWX: 84443 Xebec G
Italy
39-6-344412
TWX: 622685

SALES, U.S.A.
Sunnyvale, CA (408) 733-4200
Irvine, CA (714) 851-1437
Atlanta, GA (404) 457-9872
Boston, MA (617) 740-1707
Dallas, TX (214) 361-0687
Baltimore, MD (301) 992-7377
Federal (301) 621-3010
Chicago, IL (312) 931-1420

U.S.A. AND CANADA DISTRIBUTORS
Kierulff
Hamilton-Avnet
Avnet Electronics
Hamilton Electro Sales

Circle 27 on reader service card

Draw Your Way to the Top

PC-Draw Will Increase Your Office Productivity. And Upward Mobility.

Imagine. You now have the capability to graphically depict your best ideas, plans, designs and proposals. *In color or black & white*. Accurately. Completely. Dramatically. Concepts presented so forcefully—yet so simply—that you leave that critical meeting with upper management... *totally* confident of success.

And you win. Your secret weapon? PC-Draw. A powerful interactive graphics program for the IBM PC or XT™—*unlike anything else* on the market. Using PC-Draw you create virtually anything that can be drawn with pencil and paper. Quickly. Easily. With far greater detail.

PC-Draw is ideal for presentation graphics, proposals, systems design, forms, diagrams... and an endless variety of charts, graphs and illustrations. PC-Draw allows you to produce drawings *up to 99 pages* long. Several templates come with PC-Draw including Flowcharting, Electrical Design, Office Layout, and Alternate Text. In addition you create and store your *own* unlimited supply of user defined symbols.

10 DAY
TRIAL
PERIOD

PC-Draw includes an *easy-to-follow* interactive tutorial. Requires IBM PC or XT™ or compatible, graphics adapter and graphics monitor. Version for PCjr available. Graphic boards, plotters at competitive prices.

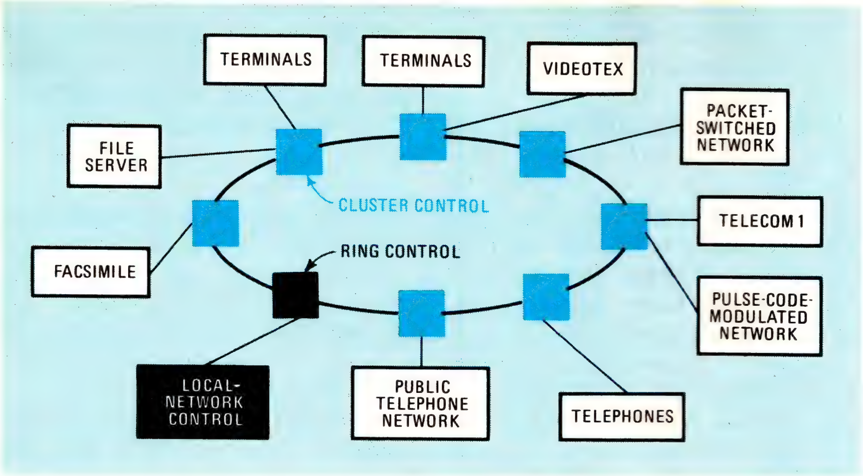
Shhh! Don't tell your office competition about PC-Draw. They'll catch on soon enough. For free brochure or to order call 800/2PC-DRAW. In Texas or for customer service call 214/234-1769. Micrografx, Inc., 1701 N. Greenville Ave., Suite 305, Richardson, Texas 75081.

MICROGRAFX

The Picture of Success.

(Most popular plotters and printers supported.)

Circle 28 on reader service card



Around the horn. The major attraction of the LCT 6500 is its ability to connect heterogeneous equipment into a local network that interfaces with the public networks.

passing that looks architecturally very much like the one that IBM Corp. has just put off introducing for at least another two years.

The LCT 6500 can connect data processing and office automation equipment of disparate origins into a coherent system. The company feels that the LCT 6500, with the aid of several second-source agreements, should be able to take a comfortable piece of at least the domestic market and, perhaps, do well in foreign markets, too.

On the face of it, prospects look bright. For a start, LCT estimates that in France there are no more than 150 local nets installed throughout the country, so its home market is far from saturated. On the international side, there are far more companies producing data processing and office automation equipment than are capable of knitting them together into a private network. This bodes well for the existence of potential suitable partners.

Breathing room. IBM's tardiness in introducing the token-ring network developed at its Zurich research center [*Electronics,* Nov. 17, 1983, p. 86] takes some of the heat off its competitors, and LCT is no exception. But the company suspects that the U.S. giant might not be entering the market for lack of a product to offer.

"Obviously, we can't speak for IBM, but it would seem that their reluctance to enter the local network market is at least partially due to it not being in their interest to promote equipment heterogeneity," reasons Jean Perrault, deputy director of the company's Telecommunications Division. "There are also rumors about internal squabbles over exactly which local area network solution IBM should employ." That gives LCT some breathing space to form the alliances with equipment manufacturers that the company feels are essential to its success.

The company will not divulge the names of the potential partners with which it is holding discussions. But when the marketing of LCT 6500 does get into full swing, the company's message will be that the system is a low-cost way of getting through the bottleneck holding back the evolution of a customer's current and future equipment into a homogeneous network.

Autonomous control. The LCT 6500 is a multiservice business network capable of integrating voice and both circuit- and packet-switched data. Its basic component is called a cluster control unit and contains two buses: an 8086 microprocessor bus and a synchronous bus consisting of four 2-Mb/s serial buses.

Each cluster control unit can operate autonomously. In most applications, however, several are connected together by a unidirectional digital link which thus forms a logical ring. Physically, the network is configured as a daisy, with each cluster control unit an independent petal, to avoid reliability problems that would occur in a physical ring if one of the components failed. Each network user—terminal, telephone, mainframe, or mini- or microcomputer—is connected to a cluster control unit by a twisted pair.

Information is transmitted around

LCT 6500 dispels doubts about CGCT's future

The introduction of the LCT 6500 comes after a prolonged period during which Compagnie Générale des Constructions Téléphoniques was generally viewed as a company with an uncertain future. Questions first came up in 1981 when the company, a long-time subsidiary of ITT Corp., suddenly found itself under state control as part of the French Socialist government's sweeping nationalization program.

That put an abrupt end to the Parisian company's role in ITT's telecommunications switching program and left an enormous vacuum in its product portfolio, which was almost exclusively based on ITT products. CGCT's void in the central-office-equipment field was finally filled with the negotiation of a license to produce the Thomson-CSF MT family of digital switches; still, the company needed more than that specialized line.

In an effort to balance its catalog with an offering in business communications gear, CGCT had its subsidiary, LCT (Laboratoire Central de Télécommunications), work out an accord last year with the French Direction Générale des Télécommunications for the development of an industrial version of Carthage, a prototype local net that had been designed at the Centre Commun d'Etudes de Télévision et Télécommunications in Rennes.

LCT already has a working prototype of the network installed at its headquarters in the Paris suburb of Vélizy. The fact that the product could so quickly be readied for market is due in no small measure to LCT's deep involvement in the development of ITT's System 12 digital switch. The French company took advantage of the experience thus gained in distributed architecture and applied it to the related problem of a local net with distributed control. –**R.T.G.**

the ring by a token-passing multiplexing system. A token, consisting of 128 temporal intervals of a byte, is passed from user to user at a rate of 8 MHz. Each station extracts any information addressed to it and inserts any information destined for other stations. The token takes exactly 125 μs to circle the ring. All time intervals are controlled by a synchronization control unit, and a ring control unit provides access for network management and service.

One of the LCT 6500's biggest assets is its formidable capacity. Each cluster control unit is capable of connecting a mix of about 100 telephone subscribers, plus 50 asynchronous terminals and eight synchronous links. **–Robert T. Gallagher**

HOLOGRAPHY

Stereo holograms speed car design

Minneapolis—Optical special effects, including holography, have long been in Walt Disney Productions' bag of tricks. Now, three researchers whose work for Disney, in Burbank, Calif., included the design of holographic figures used at the Epcot theme park in Orlando, Fla., are hoping to parlay their expertise into success in the industrial world.

The first public exposure for the three-month-old company formed by the group came at the Siggraph 84 exhibition here in late July. The fledgling firm, known as Advanced Dimensional Displays Inc., was featured at the Cray Research Inc. booth, where showgoers got a look at a complex holographic image of a computer-designed automobile that was produced with the aid of a Cray 1/S supercomputer.

Referred to as a holographic stereogram, the three-dimensional automobile image represented the first fruit of Advanced Dimensional Displays' contract with Ford Motor Co. to develop holographic techniques for visualizing an automotive design. Ford hopes to save time and money by reducing the need to produce clay models, says Tom C. Holka, principal design engineer in the advanced engineering department at the Ford Design Center in Dearborn, Mich.

Ford's traditional technique involves the initial sculpture of a ⅜-scale clay model of a car design. If it looks good, the next step is the creation of a full-size clay model, which is then placed in various settings with real automobiles for an idea of how it would look on the road, Holka explains.

However, a design that looks good in miniature often takes on a different aspect when built to full size. This leads to multiple redesigns requiring laborious repetition of the modeling steps.

"If we could turn a computerized [car] design into a hologram that could be viewed and evaluated on the basis of a full-size projected image, we could review a heck of a lot more models than we can in clay," Holka observes.

Turning it out. In creating the holographic image shown at Siggraph, Ford's concept sketches were first put into computerized form using minicomputers running the automaker's Product Design Graphics System (PDGS). The mathematical descriptions of the body surfaces were then converted to a polygonal mesh consisting of more than 35,000 polygons using a PDGS finite-element subsystem.

This graphic mesh was then fed into the Cray machine, which crunched numbers for more than 10 hours using a modified version of a continuous-tone color-graphics package known as MOVIE.BYU.

In all, the system generated 270 images of the car, stepped through 90° of viewing angle with the angles 0.33° apart. "As far as I know, this is the largest model that has ever been produced using MOVIE.BYU," says Michael G. Long, a programmer/analyst at Cray. His company contributed computer time and technical assistance to the automotive project at its Mendota Heights, Minn. facility.

The 270 frames generated on the Cray 1/S were then transferred to tape and displayed on a Ramtek display, finally to be photographed by Advanced Dimensional Displays' cameras. Each image was exposed on a vertical strip of high-resolution silver halide-based holographic film. The film was then attached

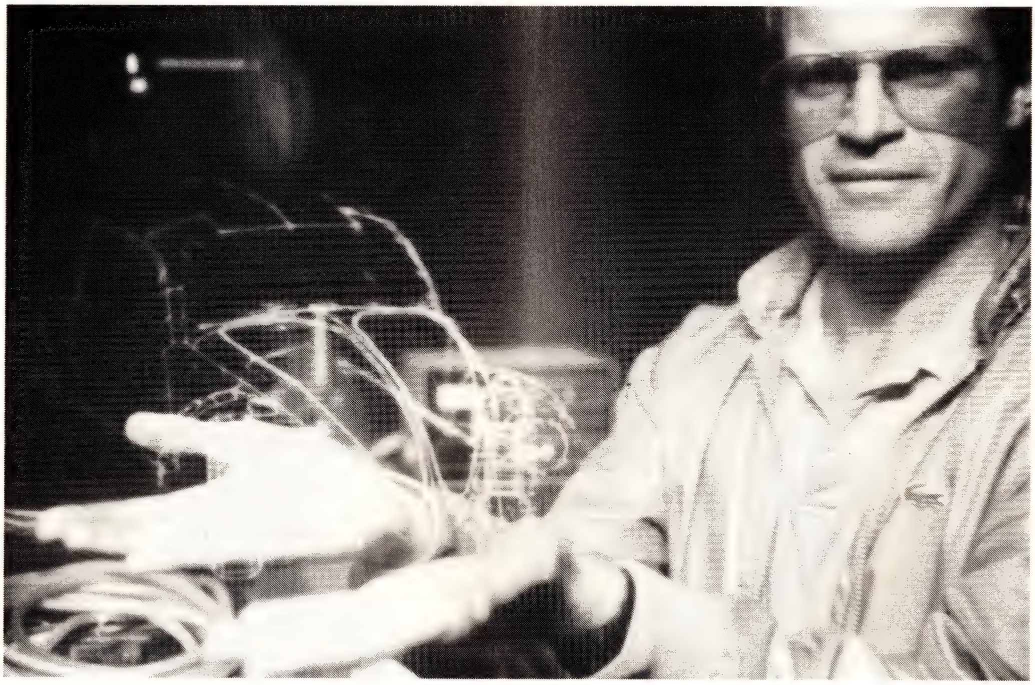


Image. Ford Motor Co. doesn't design cars that look like the wire-frame hologram ADD president Chris Outwater has in his hands. But Outwater believes his company can cut Ford's design costs with holographic stereograms.

to a transparent viewing cylinder and subjected to low-level laser light, which diffracted to produce a holographic image.

By looking through the cylinder, viewers at the Siggraph show were able to see the automobile image in apparent 3-d. Because each eye sees only one strip of the hologram at a time, the brain's natural stereoscopic ability turns the differing perspectives seen by each eye into the illusion of depth perception. By walking around the viewing window, Siggraph showgoers were able to view the automobile image from different perspectives.

Although the Siggraph exhibit proved the concept works, Ford's Holka notes that a number of problems with the technique still must be overcome before the automaker would consider adopting the method for its design-production facility. For example, the image must be produced in a variety of colors matching those used on an actual automobile, and in full-scale size. The Siggraph demonstration image was only about one tenth actual size.

At Advanced Dimensional Displays, based in Van Nuys, Calif., president Chris Outwater says continued development could lead to a system meeting Ford's requirements perhaps within two years.

Meanwhile, the young firm plans to pursue other contracts it has with Ford and others. Among them is a project aimed at producing a holographic-based head-up display similar to those used today in military aircraft, but at a cost low enough for automotive applications.

Before the new company's incorporation in May, the 35-year-old Outwater worked as a consultant to WED Enterprises, a Disney subsidiary in Glendale, Calif., involved in theme park development. His cofounders, Bill Redman, 25, and Craig Newswanger, 31, are former WED employees. "Disney just didn't have the money to support us," Outwater says. But he is quick to add that the company has provided the new firm with considerable support, including a year's free use of holographic equipment that WED had owned. **–Wesley R. Iversen**

SEMICONDUCTOR TECHNOLOGY

Britain getting its act together in SOI technology in bid to get jump on U.S. and Japanese chip makers

London—Individually, Britain's specialist chip-manufacturers are no match for their American and Japanese rivals; but together they are finding a joint research strength that could propel them to the forefront in the race to develop a viable silicon-on-insulator technology, which may be a mainstay for integrated circuits during the next decade.

Through a research cooperative involving three companies, four universities, and two government research laboratories, four different routes to the manufacture of low-cost SOI wafers are under evaluation. Without cheap substrates, SOI seems doomed to remain a niche technology.

"SOI will cover a very substantial part of the total silicon IC market requirement," asserts David Smith, who heads up development of silicon-on-sapphire technology at the Hirst Research Centre of Britain's General Electric Co. plc. "Any company that succeeds in entering the market with a sufficient lead on the competition would have a license to print money."

So far, SOS is the only production SOI technology, but the high cost of sapphire substrates—about five times that of bulk silicon—has limited the technology mainly to military applications. Oxide-coated silicon wafers could provide a cheaper alternative that would break open the market (see "Why low-cost SOI would be a winner.")

Silicon dioxide is a good insulator and can be formed simply by heating silicon in an oxidizing atmosphere. But if a working layer of silicon is then deposited atop the oxide, it is too grainy for fabricating devices. The trick is to recrystallize the layer, which is between 3 and 5 μm thick, so that it becomes a single crystal. Lamps, graphite heaters, electron beams, laser beams, and ion beams have all been used to heat the wafer in a way that transforms the grainy polysilicon layer without damaging the underlying substrate. On cooling,

Why low-cost SOI would be a winner

MOS technology fabricated in bulk silicon has brought the microcircuit industry into the the era of very large-scale integration. However, as transistor dimensions shrink below 1 μm, new problems emerge. In particular, capacitive loading and parasitic coupling between active devices and the bulk substrate severely limit the performance of the chips.

This problem can be largely overcome by fabricating devices in a thin island of silicon atop an insulating substrate. Such silicon-on-insulator processes have many advantages; simpler processing, no channel-stop isolations, no deep p- or n-type wells, and no need for the trench isolations necessary to prevent latchup in the bulk-silicon substrate.

Such circuits should be stellar performers. They would be highly dense, switch at speeds matching those of emitter-coupled logic, and consume only microwatts of power. What's more they would be resistant to ionizing radiation—whether caused by nuclear radiation or stray alpha particles. And if the insulation of the substrate is properly exploited, SOI offers high-voltage capability as well. **–Kevin Smith**

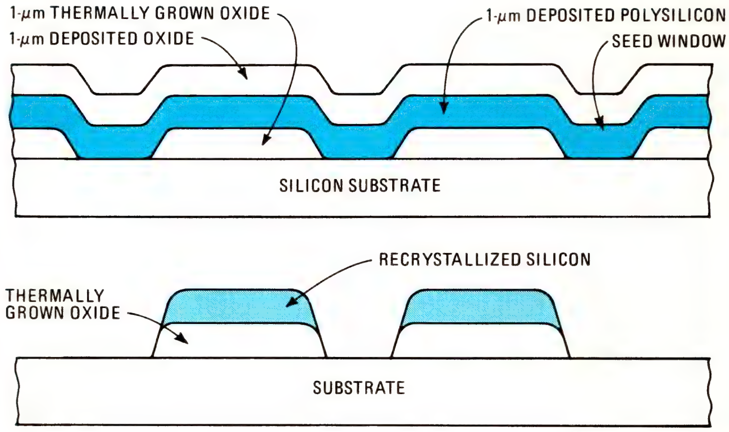
Cambridge lab heats wafers top and bottom

Researchers at the Microcircuit Engineering Laboratory of the University of Cambridge are pressing ahead with a technology they think may make them a front runner in the race to turn silicon-on-insulator technology from a laboratory technique into a cheap and practical process. Under the direction of Haroum Ahmed, they have worked up a twin-electron-beam system that simultaneously bombards a silicon wafer top and bottom with precisely metered doses of energy. This procedure melts a 3-μm amorphous silicon layer deposited atop an oxide-coated wafer, without damaging the underlying substrate. As the wafer cools, a high-quality single-crystal silicon layer that is suitable for the manufacture of active devices is formed.

In operation, the lower beam scans the wafer's back surface. In doing so, it heats the wafer to a uniform background temperature of 1,100°C, turning it cherry-red in seconds. Meanwhile a top beam, focused to a spot 60 μm in diameter, is scanned across the wafer surface to produce local surface melting. The lab says that the setup is precise, flexible and fast, taking just 30 s to anneal a single wafer.

To form a single-crystal silicon film of a known lattice orientation, seeding windows must be cut at regular intervals in the wafer's oxide skin, exposing the underlying silicon substrate. Amorphous silicon is next deposited to a thickness of around 3 μm. This layer is then covered with a capping oxide film to contain the polysilicon while it is molten. After recrystallization using the twin electron beams, the capping layer is taken off. A second masked etching process is then carried out to remove the silicon film over the seeding windows. This operation isolates the single-crystal upper silicon layer from its substrate (see cross section). The 100-μm-wide silicon stripes can then be used to manufacture active transistor devices, using fairly conventional processing schedules and mesa-etched isolation.

–Kevin Smith



the molten silicon recrystallizes around a seed crystal to form a single-crystal silicon layer of the same crystal orientation.

There are other ways, as well, to fabricate SOI structures. One makes use of porous silicon, for example. In another, oxygen is implanted at high energy into the substrate to form a buried silicon dioxide layer.

Four lines. All in all, the range of possibilities is beyond the means of any one company to explore. Even the British consortium, whose coordinator is GEC's Hirst Research Centre in Wembley, is focusing on only four main lines of research: electron-beam annealing; ion implantation of oxygen; graphite-heater annealing; and porous silicon, in which substrates are anodized to make areas surrounding active regions porous and thus easily oxidized to isolate device islands. The aim is to pool the early results before picking one or perhaps two likely winners.

All four approaches have resulted in active devices. But research now is concentrating on two of them: a dual electron-beam wafer-annealer developed at the Microcircuit Engineering Laboratory of the University of Cambridge and a high-powered ion implanter now being designed at the Atomic Energy Research Authority's Harwell Research Centre.

On the beam. Researchers are now scaling up laboratory gear to assess likely production yields and costs. For example the Hirst Research Centre has teamed with the Cambridge lab, where a research team under Haroum Ahmed has developed an electron-beam machine for the production of single-crystal SOI films of high quality (see "Cambridge lab heats wafers top and bottom.")

Hirst is commissioning the Cambridge lab and a sister company, Marconi Avionics Ltd., in Boreham Wood, near London, to develop a larger rig that will anneal a 3-in. silicon square on a 5-in. wafer and so would give realistic yield figures. A production version might cost in the region of $260,000, comparable with most clean-room gear nowadays, and anneal a single wafer in 30 s. With carousel-to-carousel loading, the system would have high production throughputs and be well able to deliver low-cost SOI wafers.

Meanwhile, the Plessey Co. plc, at its Allen Clark Research Centre, Caswell, Towcester, Northants., is pursuing two lines of research. First, it is using a graphite heater scanned over the wafer to anneal amorphous silicon, an approach pioneered at the Massachusetts Institute of Technology [*Electronics,* Sept. 8, 1983, p. 58]. Second, it is producing SOI substrates by implantation of oxygen ions that form a buried oxide layer in the silicon substrate. Specimen wafers have been produced for Plessey at the University of Surrey, with good results. Middlesex Polytechnic North London, collaborates with Plessey in the work as well.

However, to be economical, the process needs an implanter with a beam current roughly 10 times that of present-day machines. At Harwell, a $2.1 million machine with a beam energy of 200 kV, an ion-beam current of 100 mA, and a throughput of

10 wafers/h is in the works [*Electronics,* Feb. 9, 1984, p. 71].

Two other research centers in the consortium are the Royal Signals and Radar Establishment, Malvern, and British Telecom's Martlesham Research Centre. Malvern, in a joint effort with Birmingham University, is evaluating porous silicon although this work is not as well funded as the other two efforts. At British Telecom, mesa-etching and oxygen-implantation techniques for isolating active devices in the SOI substrate are being studied. **–Kevin Smith**

AUTOMOTIVE

Nickel-iron battery powers French car

Paris—As the small hatchback zips through the streets of Paris, the only thing about it likely to catch anyone's attention is what is missing—the noise and exhaust fumes. The car is the electrically powered Peugeot 205 Electric, developed by the French automobile manufacturer Peugeot S.A. Though it can't claim the performance of a gas-powered automobile, its acceleration, speed, and range are impressive for one that runs on electricity.

The 205 Electric has a top speed of over 60 mph and can accelerate from a standing start to 35 mph in 11.6 s. Its operating range is about 100 miles in normal city driving or at a steady 45 mph; at 27 mph, the range rises to about 140 miles. Unlike earlier electric cars, whose trunk space was loaded with batteries, the car's trunk can hold luggage. Its twelve 6-V batteries and power plant—a dc motor with a nominal power of 8 kW and a maximum power of 17.5 kW—nestle together under the hood.

According to company officials, the key breakthrough behind the 205 Electric is an advance in battery technology—the fruit of a research program carried out by Peugeot and the Société des Accumulateurs Fixes et de Traction (SAFT), a subsidiary of the Compagnie Générale d'Electricité that specializes in the manufacture of batteries and related products.

Though few details on the batteries have been made available, they are realized in a nickel and iron technology with cells that are not completely isolated like those of standard batteries. A convenience is that the cells can be filled in a single operation from a common opening.

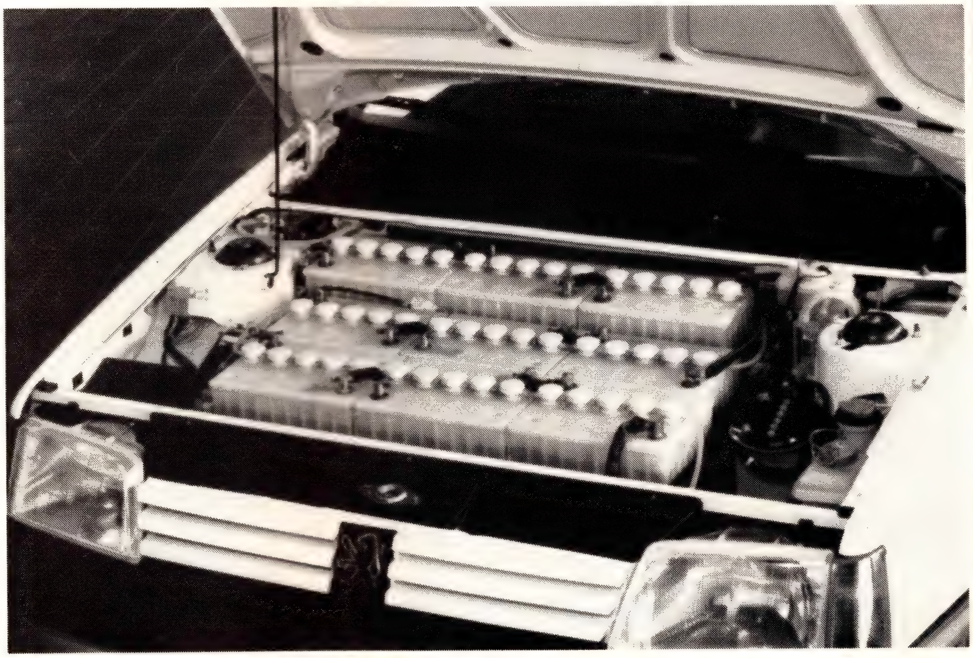
The 6-V batteries have twice the energy capacity of standard batteries with an identical weight and volume. What's more, they have an exceptional life expectancy of about 125,000 miles and can go through at least 1,500 recharge cycles.

Under the hood. The only place the 205 Electric does not look like a standard automobile is in the engine well. Two current choppers control the motor: a main chopper with asymmetrical thyristors that operate at the bottom third of the motor's power range and a transistorized excitation chopper that controls the motor at medium and high power ranges. The motor itself connects to the front wheels through a reduction gear.

The electronic control system makes a transmission unnecessary. The choppers constantly monitor energy flow. Releasing the accelerator breaks the flow and puts the motor into a generator mode so that its energy is diverted to charge the battery. To put the car in reverse drive, the driver uses a switch on the 205 Electric's dashboard.

Despite its list of advantages, the 205 Electric has some standard electric-vehicle drawbacks. Recharge time, for example, can be as long as 10 h, and the batteries are very expensive to make—about $2,500, with no reason to believe that full production would decrease that figure significantly, as much of the cost is a function of expensive materials. If the car were to be manufactured in the same volume as internal-combustion-engine vehicles, it would be no more expensive, but because of the restrictions of an electric vehicle, that market just doesn't exist. Peugeot sees, at least in the beginning, the public service as the main market for the cars.

In Europe, other electric-car schemes are continuing. Regie Renault is working on large electric vehicles for industrial applications, and Volkswagen has a project to make an electric Golf (called the Rabbit in the U.S.). The British government has a plan to promote electric vehicles, and Clive Sinclair will soon be unveiling his much-talked-about entry into the market. The Swiss company Brown Boveri Corp. has just



Well-packed. The nickel and iron batteries in this Peugeot 205 Electric pack twice the energy of ordinary batteries of identical weight. The body is the firm's standard 205 and the range nearly 100 miles.

begun its own project. In the U.S., interest has slacked off a bit since the Carter administration heavily supported electric vehicle research. Ford Motor Co., however, is continuing its project aimed at developing an electric car with alternating current power plant. **–Robert T. Gallagher**

MEDICAL

Image transfering gathers steam

Arlington, Va.—Physicians today are performing tests that are increasingly complex and expensive. Often, the test results must be quickly transferred from a large hospital where they are obtained to a distant clinic where a patient awaits treatment. Because of this, picture archiving and communication systems for images generated by medical diagnostic procedures are raising interest.

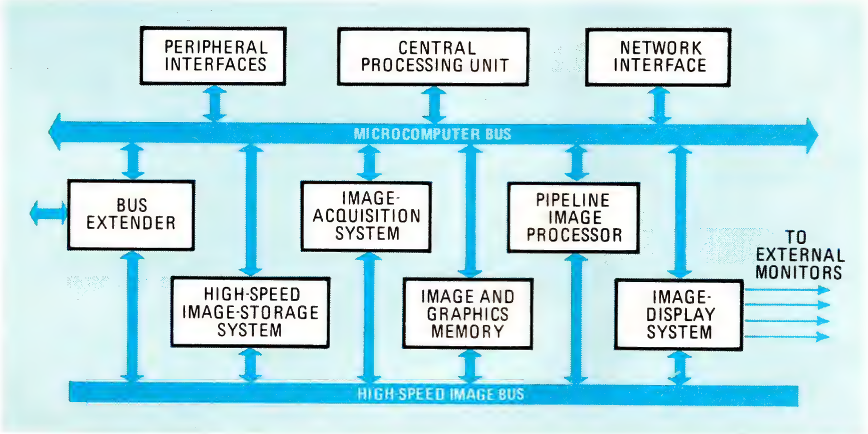
PACS, as they are known, are high on the list of doctor's priorities, to judge from the Symposium on Medical Images and Icons, held here in late July under the sponsorship of the Institute of Electrical and Electronics Engineers. There, a major topic was the development of standards for medical image exchange.

According to Ken Kita, a staff engineer at Toshiba, Inc.'s Medical Engineering Laboratory in Tokyo, the modalities of electronic medical imaging—ultrasound, nuclear medicine, computerized axial tomography, magnetic resonance, and digital radiography—can be readily quantified and lend themselves to diagnostic precision. But their usefulness is limited if they aren't accessible to other physicians, who are often at widely scattered locations.

Tape format. Kita presented a paper outlining a standard format for digital picture storage on magnetic tape. The format is an outgrowth of of a proposal by the Information Processing Society of Japan for digital image storage in general. Now promoted by the Japan Medical Industries Committee (JMIC), it has four main features that, says Kita, permit its adaptation to the main modalities of medical imaging:

- ■ Any number of bits can be assigned to a pixel.
- ■ Two-dimensional images can be located with respect to each other, that is, at different points on a z-axis, and be reinterpreted as a 3-d image.
- ■ Digitized data from different modalities can be compared.
- ■ Data from any of the modalities can be transferred across a local network or over a standard phone line.

At present, however, two issues in medical image transfer have yet to be resolved. The first is the speed of transmission. It takes 4 to 5 min to transmit a single X-ray picture over the phone, and the picture often winds up with less clarity. A local network such as Ethernet offers greater image integrity and can handle substantially more data—up to 10 million instructions per second—but is still considered inadequate for the transmission of detailed pictures in real time.



PACS network. In this medical image processing system, data is voluminous and transmission speed must be high. The network also needs provision for redundant storage.

Prof. Hans Roehrig of the University of Arizona at Tucson, believes that a digitized image with a raster size on the order of 2,048 by 2,048 pixels is probably necessary to compete with film. "While current imaging technology can achieve this definition, the transmission of such a detailed picture will be very slow with anything but fiber optics," he says. "Even a 1,024-by-1,024 raster with a gray-scale definition of 10 bits per pixel can take a painfully long time over Ethernet, and with color the transmission time goes up by a factor of three."

Complex. The second issue is the complexity of the network itself. Thomas Risser of Vicom Systems Inc., in San Jose, Calif., points out that an effective network must work as an extension of the image processor's data bus. Says Risser, "The remote consoles should have basic processing capability such as gray-scale manipulation and zoom, so that the majority of image-review activities are performed locally and do not tie up the network." Of course, this implies that each local substation has its own memory—a potentially expensive proposition.

"But adequate memory is indispensable," explains Philip Drew, president of Drew Consultants, in Carlisle, Mass., "And a big factor in the total system cost is ensuring redundancy in both long- and short-term medical archives." The most vital consideration in medicine is patient safety, so the image must not only be reliably transmitted but also stored at both the site of acquisition and the site of its ultimate use. An electronic image destroyed by static overload just before a patient is to undergo major surgery would not be competitive with film.

Most PAC designers believe that only optical disks have any long-term potential. Other techniques being explored by JMIC, such as those that involve daisy-chaining Winchester disk drives, can be at best stop-gap measures as PACs become more and more complex.

So far, only Shugart Associates, of Sunnyvale, Calif., is promoting laser-based systems such as PACS for medical use. Its Optimem 1000 has a 1-gigabyte capacity on a 12-in. disk and can be interfaced to other storage systems. **–David M. Weber**

Vendors, users embrace Graphics Kernel System as acceptance by standards bodies in the West nears

Minneapolis—Now that the Graphical Kernel System is nearing final acceptance as a true international graphics standard, momentum is rapidly building toward its adoption among users and software vendors alike. GKS was very much in evidence at the recent Siggraph 84 show here, where a number of GKS-based products were introduced, and exhibitors reported a high interest level in the emerging standard.

Approval of GKS is near at the American National Standards Institute, and the International Organization for Standardization (ISO) has already accepted it. In the U.S., it will likely coexist with the earlier Core standard developed by Siggraph, the Special Interest Group for Graphics of the Association for Computing Machinery.

Firms unveiling new GKS products at the show included Precision Visuals Inc., a five-year-old Boulder, Colo., graphics software supplier that has built the bulk of its business on products that conform to the earlier Core standard. Its new GK-2000 package, which consists of a library of some 200 user-callable subroutines based on GKS, is set for initial deliveries in the fourth quarter.

Many vendors. Together with the Precision Visuals' flagship DI-3000 Core-based product, the GK-2000 will be offered by such hardware vendors as Control Data Corp., Zilog Inc.'s Systems Division, Ridge Computers and the Computer Systems Division of Harris Corp. GK-2000 is compatible with the full range of device drivers already available for DI-3000, thus enabling GK-2000 users to write graphics application programs that address more than 80 different output devices, including cathode-ray-tube displays, pen plotters, and printers.

Also set for fourth quarter delivery is Dimension GKS from Megatek Corp., San Diego. As a graphics programming tool that will be interfaced to Megatek's existing library of over 125 graphics-device drivers developed originally for its own Template graphics subroutine library, Dimension GKS is based on the NOVA*GKS package from Nova Graphics International Corp.

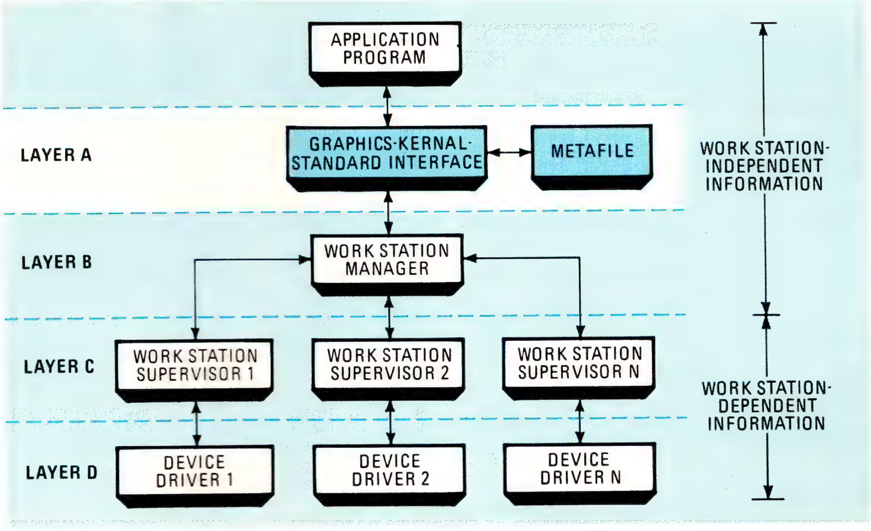
Nova Graphics, a 15-month-old Austin, Texas, firm, is an example of a company that is banking heavily on GKS acceptance for its success. NOVA*GKS is the firm's first and only product, points out Christopher M. Melson, manager of customer support and quality assurance. The package is offered in both a mainframe-host version written in Fortran that was released in January and in a compatible microcomputer version done in the C programming language that was released last month. The two versions are compatible and are designed to facilitate highly distributed computing applications by allowing part of NOVA*GKS to reside on a host and part on attached microcomputers.

While Megatek is the first company to sign up to distribute the NOVA*GKS product, negotiations are underway with a number of other vendors, Melson says. Eight initial device drivers designed to work with the package were released in July, and Nova Graphics announced a schedule at the Siggraph show for the availability of 31 additional drivers between now and the end of next year's first quarter.

Hot topic. At the Tektronix Inc. booth, systems analyst Lucy Trebotich reported more questions than expected regarding the firm's PLOT 10 GKS package that has been shipping since May. The giant Beaverton, Ore., instrumentation manufacturer was one of the first heavyweight hardware vendors to jump on the GKS bandwagon, announcing plans for its package at last year's Siggraph exhibition in Detroit [*Electronics,* Aug. 11, 1983, p. 50]. Digital Equipment Corp., of Maynard, Mass., has also introduced a GKS product.

Altogether, at least 17 companies were touting GKS software offerings at the Siggraph show. Besides those firms already mentioned, other vendors included Advanced Technology Center Inc., AutoCAD, Benson Inc., Control Systems, FutureNet Corp., ISSCO Graphics, Ramtek Corp. and UNIRAS Inc.

"A lot of people at the show are


APPLICATION PROGRAM
LAYER A
GRAPHICS-KERNAL-STANDARD INTERFACE
METAFILE
WORK STATION-INDEPENDENT INFORMATION
LAYER B
WORK STATION MANAGER
LAYER C
WORK STATION SUPERVISOR 1
WORK STATION SUPERVISOR 2
WORK STATION SUPERVISOR N
WORK STATION-DEPENDENT INFORMATION
LAYER D
DEVICE DRIVER 1
DEVICE DRIVER 2
DEVICE DRIVER N

Independent. Because of its architecture, NOVA*GKS can be distributed between a host computer (layers A and B) and various work stations (layers C and D).

saying they've got to have GKS," observed Joseph Rauh, a product manager at ISSCO. The San Diego firm will offer a limited GKS package in December that will run as an option to the company's DISSPLA graphics subroutine plotting language. In the same time frame, says Rauh, ISSCO will also offer selected GKS segmentation capabilities in another option to be called Dynamics that will allow DISSPLA to be used in an interactive mode. (Segmentation is the ability to identify components of a picture for selective manipulation.)

Because GKS defines the interface between graphics applications and any number of graphics output and input hardware devices, it will allow software portability, eliminating the need for extensive rewriting when moving applications from one vendor's device to another. As such, it will lead to improved productivity for graphics programmers by allowing them to concentrate on the application instead of the underlying low-level software, proponents say.

Unlike the Core standard, which has been implemented in various noncompatible guises by different vendors, and which has suffered from a lack of standardized subroutines for binding to particular programming languages, the GKS standard currently provides for Fortran and Basic bindings. Additional bindings to Ada, Pascal, C, and Pl/1 are in the works, and a task force from ANSI's X3H3 committee on graphics standards plans to begin work on a Cobol binding for GKS in October.

German work. Developed originally by the West German standards organization Deutsches Institut fur Normung (DIN), GKS has already received approval from the ISO. In the U.S., ANSI completed the public review phase last month and should publish GKS as a standard late this year or in early 1985.

A major criticism of GKS is that it allows for only two-dimensional graphics, unlike the 3-d Core standard. But work began last fall on GKS 3-d extensions, with plans for circulation of a first draft this fall, says X3H3 chairman Peter Bono. He anticipates circulation by mid-1985 of a second draft that "we hope will be close to something people can implement."

While GKS is currently coming on strong, it is expected to coexist in the market with Core. Indeed, at Precision Visuals, vice president William H. Perry says sales of the firm's Core-based products should rise from about $4 million to $5 million last year, to about $11 million in 1984, accounting for more than 75% of its projected $14 million in sales.

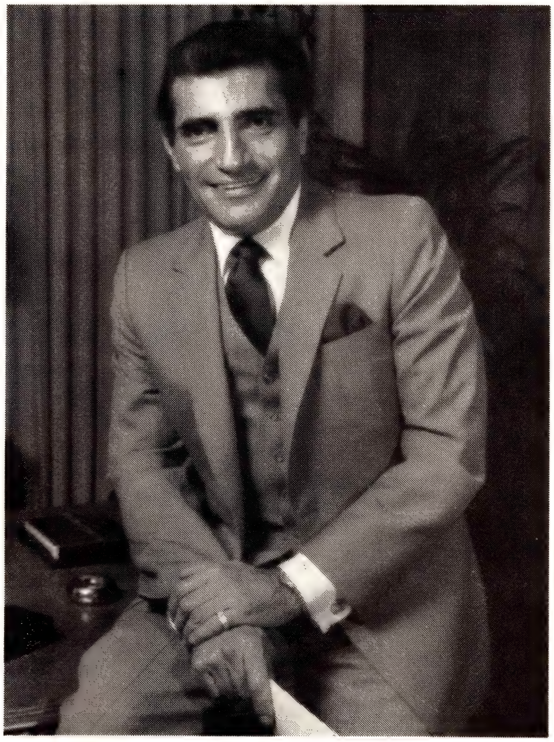
"Ultimately, any standard is valuable only to the extent that it fulfills a user's needs," maintains James Warner, who is the president and chief executive officer of Precision Visuals. "Frankly, we expect many customers to install both a Core and a GKS product in order to tap the strengths of each," the software executive predicts. **–Wesley R. Iversen**

STRATEGIES

Companies salvage profits from manufacturing junkyard

Los Angeles—One aspect of this success-oriented industry is that companies seldom discuss in public those products that miss big growth targets or whose sales are dropping. And most firms have more examples than they care to admit.

But it is understood that supporting marginal or failed products with service, replacements, and inventory is a bedrock obligation that customers demand and suppliers guarding their reputations dare not ignore. Although seeming to offer little chance of profit to anyone, it is exactly such lines from which E.F. Industries is building an expanding, and profitable, business.



Gold. There is a lucrative business in making and supporting computer subsystems and products abandoned by their original vendors, says E.F. Industries' Edward Farris.

Founder and president Edward Farris states his goal plainly: "I want products someone has put $20 million into and [which have] failed." Starting with a line of IBM-compatible memory systems bought in 1980 from Electronic Memories & Magnetics Corp., he has acquired so many spun-off businesses that his privately owned Hawthorne, Calif., firm now has annual sales of some $12 million. The latest orphans to come under E.F. Industries' wing are cartridge disk drives, subsystems, and related equipment bought from Cipher Data Products Inc., San Diego, whose thrust now is the more advanced streaming-tape drives.

Although his experience in buying such lines has taught him what to look for ("Most important, never acquire a bad product with reliability problems"), the well-tailored Boston native admits to having made mistakes early on. "We were pioneering—there was no role model for it," he explains. Topping the list of mistakes was paying too

UNIX® IS A DINOSAUR CP/M® & MS-DOS™ ARE TOYS

MULTI SOLUTIONS PRESENTS

THE WORLD'S FIRST 4th GENERATION

OPERATING SYSTEM

S1™

A SERIOUS OPERATING SYSTEM

FOR TODAY AND TOMORROW

- PORTABLE
- MODULAR
- MULTIUSER
- MULTITASKING
- MULTI PROCESSING
- PARALLEL PROCESSING
- 64 CHARACTER NAMES
- 3 COMMAND PROCESSORS
- REAL TIME
- NETWORKING
- DISTRIBUTED PROCESSING
- HIERARCHICAL DIRECTORIES
- KEYED FILES
- ISAM
- VSAM
- B-tree
- RECORD LOCKING
- UNIX SOURCE COMPATIBLE
- WINDOWING
- BIT MAPPED DISPLAYS
- FULL SCREEN MANAGEMENT
- FULL SCREEN EDITING
- FULL MEMORY MANAGEMENT
- VIRTUAL MEMORY
- SEMAPHORES & LOCKS
- EXTENSIVE UTILITIES
- AND MUCH, MUCH MORE

S1 IS THE ONLY OPERATING SYSTEM WORTHY OF THE TITLE:

"THE NEXT WORLD STANDARD."

ONLY S1 DOES IT ALL.

NO OTHER OPERATING SYSTEM COMES CLOSE. CUTS DEVELOPMENT TIME FROM MAN YEARS TO MAN MONTHS.

MULTI
SOLUTIONS
INC.

Multi Solutions, Inc.
123 Franklin Corner Rd.
Lawrenceville, N.J. 08648
609-896-4100 Telex: 821073

Please send for our **FREE S1 Book or Call 609-896-4100**

IN TIME, ONLY THE BEST WILL SURVIVE: S1

---

*Reg. Trademarks: CP/M of Digital Research; Unix of Bell Laboratories Trademarks: MS-DOS of Microsoft, Inc.

Circle 37 on reader service card

steep a price, even though the first purchase was made for about 25% of the asset value of production equipment and parts. He knows better now, shelling out little more than 5¢ per dollar of the asset value and often even less than that.

E.F. Industries' advantage in negotiating is that sometimes the seller cannot drop the line and needs someone to take over the obligation. Once the firm purchases a product line, giving service to existing customers is the key profit item, Farris says, so it is very important to do it well.

"We make money doing repairs. Some customers have never had it so good," Farris boasts. Once the deal is made, he prices service and the product itself to make money.

Lucrative demand. Previous owners often gave products away at a loss, he notes. One example is the 8-in. floppy-disk line made by PerSci Inc., a failed Los Angeles company heavily backed by venture capital firms in the late 1970s.

Its drives originally sold for $1,800; now they go for $3,800. Customers who are locked into this drive by its unique format would rather pay up than go through an even more costly redesign. These drives are still selling well—in fact, better since E.F. Industries acquired the product in 1982, according to Farris.

He learned the hard way about failing lines, since he was the boss of EMM's IBM-compatible memory business when IBM price cuts pulled the rug out from under all competing suppliers. When no one would buy EMM's business, he put together a group and took it himself, finding that its pessimistic prognosis was not warranted. "We have made good profits on it since," he notes.

He later bought another former EMM line (Caelus Memories Inc.'s recording media and disk drives) and the minicomputer mass-storage controller family from Datum Inc., Anaheim, Calif. He also picked up the service and support operations of Scientific Data Systems computers when Xerox dropped the business. His firm now provides support for more than 100,000 separate products through several subsidiary firms.

The firm finances itself from cash flow and bank borrowing. Farris says he is paying off debts and building a war chest so he'll be ready to buy promising products as they come on the market, especially since he believes a recession will come next year.

Currently, he is hanging tough in negotiations with a major firm that wants to sell him an obsolete computer line. "This will end up with them paying me to take it off their hands," predicts Farris, who says he gets about four or five calls a week from firms interested in selling him their unwanted products.

Nor do the only opportunities lie with electronics systems. Rochester Electronics Inc., Wakefield, Mass., is making a nice living out of providing engineers and systems builders with components that have long fallen out of favor with main-line manufacturers. "In my 20 years working in components marketing, I continually encountered customers who had special needs for devices that were plentiful just a few years ago but now, with the rapid advancement of technology, had become low-demand items and thus very scarce," says president Curt Gerrish.

He notes that he started his business by buying "ending inventories from Motorola Semiconductor," and he has since included Texas Instruments and Fairchild Semiconductor. "Component sophistication is moving forward so rapidly, I am able to build a solid business specializing in the *trailing* edge of technology," he says.

Companies such as E.F. Industries and Rochester Electronics face no apparent end in business opportunities with at least one major electronics equipment customer: the federal government. According to the Defense Electronics Supply Center (DESC), Dayton, Ohio, the move by electronics companies to newer technology products is wiping out an increasing number of established parts still required for the support of U.S. military weapon systems.

DESC, which has been tracking the phase-out of product lines needed by the military for seven years, says that so far this year it has received 82 reports of product phase outs from manufacturers. **–Larry Waller**

MINICOMPUTERS

Brazil's computer program takes a sudden outward turn

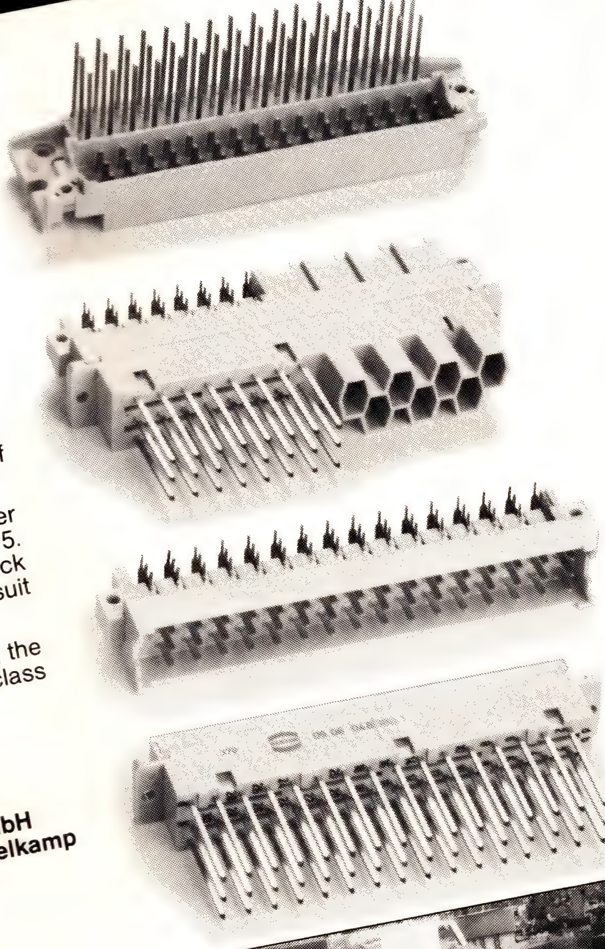
São Paulo—In a dramatic reversal of government policy aimed at developing native technology for superminicomputers, Brazil's Special Secretariat for Informatics has authorized four local groups who are eyeing the market to look abroad for partners.

SEI's ruling is tantamount to an admission of defeat for the ambitious policy. After reaching the conclusion that Brazil's market cannot support more than two or three manufacturers of 32-bit minicomputers, SEI's head, Col. Edison Dytz, attempted to persuade the four groups to merge. Failing that, the secretariat has decided to let the market determine how many of the four can make it. Other groups may also get the go-ahead to go abroad, and as many as seven of them could end up battling for shares in the market.

Some of Brazil's largest companies are involved. An association uniting Banco Brasileiro de Descontos SA (Bradesco), the country's largest private bank; the Companhia Docas de Santos, a major electronics group based in São Paulo; and Medidata Informatica e Tecnologia SA, a Rio de Janeiro computer and software company, has secured rights to purchase Digital Equipment Corp.'s VAX 750 technology.

Buying technology. Sao Paũlo-based Itautec, the computer and automation services arm of Brazil's second-largest private bank, Banco Itaú SA, is buying technology for the F4000 machine from Formation Inc., of Mt. Laurel, N.J. ABC Sistemas SA has made a deal for the DPS6 from France's Bull and is already assembling Bull mainframes in Brazil. Sisco Sistemas e Computadores SA, the computer subsidiary of the Hi-

If the standard connectors don't suit you then try the Series Gds A complementary ones. As required!



There are applications where you need connectors which cannot be covered by the ordinary DIN-standard types. In order to meet the special requirements of our customers we have developed printed-circuit connectors which complement the standard, in harmony with practical applications. It means you can always make the perfect connection – functional, fast and reliable. For instance, BUS connections.

You'll find our complementary connectors in Series Gds A both for Types B and C and for D, E, F and H, whether it be the Gds A-MH combined connector, the interface connectors or the extensive, well-conceived housing range for all the DIN Types.

A comprehensive range you'll only find at HARTING. Solutions with practical applications in mind are simply part of our philosophy.

By the way, all Gds A connectors are now available under the new classifications according to DIN 41 612, Part. 5. Clearly defined qualities will also save you money. Check your specifications and select the right connectors to suit your requirements – it's worth it!

We're helping you to reduce expense by increasing the number of Types available and insisting on first-class quality.

HARTING ELEKTRONIK GmbH
Postfach 1140 · D-4992 Espelkamp
West Germany
☎ (0 57 72) 47-1
Tx 9 72 310-11 he d

HARTING – the experienced electronic component specialists.

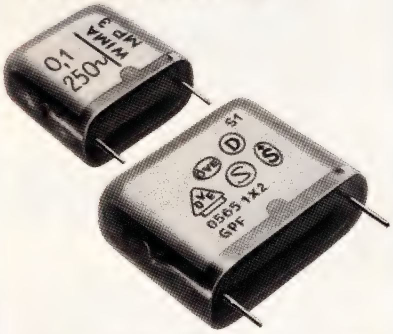
We set great store by convenient and reliable packaging so that our first-class products reach you in perfect condition and are easy to handle.

Subsidiary companies:
Belgium: N. V. HARTING ELEKTRONIK S. A., Industriezone Doornveld, Schapenbaan, B-1730 Relegem. **France:** HARTING ELEKTRONIK S.A.R.L., BP 24, F-94121 Fontenay-sous-Bois Cedex. **Great Britain:** HARTING ELEKTRONIK LTD., Airport Estate, GB-Biggin Hill/Kent TN 16 3 BW. **Italy:** HARTING ELEKTRONIK S.P.A., Via Como, 2, I-20096 Pioltello (Milano). **The Netherlands:** HARTING ELEKTRONIK B.V., Mon Plaisir 89 D, Industrieterrein Vosdonk, NL-4879 AM Etten-Leur. **Norway:** HARTING ELEKTRONIK A/S, Nils Hansens vei 13, Bryn, N-Oslo 6. **Sweden:** HARTING ELEKTRONIK AB, Fagerstagatan 3, S-163 53 Spånga/Stockholm. **Switzerland:** HARTING ELEKTRONIK AG, Eschenstrasse 2, CH-8603 Schwerzenbach.

Foreign representatives:
Austria: Burisch Ges. m. b. H. & Co. KG, P.O.B. 24, A-1210 Wien. **Brazil:** ER COMERCIO E INDUSTRIA LTDA, P.O.B. 2456, 30.000 Belo Horizonte MG. **Denmark:** Knud Wexøe A/S, P.B. 35, DK-2840 Holte. **Finland:** SKS Suomalainen Kone Oy, Laurinmaenkuja 3, P.O.B. 40, SF-00441 Helsinki. **Japan:** Yamaichi Electronics Co. Ltd., 3-chome Shibaura, Minato-ku, Tokyo 108. **South Africa:** Bowthorpe-Hellermann-Deutsch (Pty) Ltd., 80 Mimetes Road, Denver Ext. 9, Johannesburg. **Spain:** Elion S. A., Apartado Postal 7097, E-Barcelona 14. **Bulgaria, CSSR, Yugoslavia, Poland, Rumania, Hungary:** Gebhard Balluff GmbH & Co., P.O.B., A-2346 Maria Enzersdorf-Südstadt/NÖ.

Circle 104 on reader service card

The Reliable RFI Mains Capacitor
WIMA MP 3*



*Interference suppression capacitors

with the following safety marks: VDE 0565-1 class X2 (Germany), SEMKO (Sweden), SEV (Switzerland), ÖVE (Austria) and DEMKO (Denmark)

WIMA have manufactured „mains" capacitors for more than three decades. The **WIMA MP 3**-series, is the product of long experience and bold innovation. Particular attention was directed to formulating the production processes to ensure a high ionisation inception level – ionisation is the principal cause of failure in capacitors connected to „mains" or 250 V.r.m.s. supplies. The **WIMA MP 3** metallised paper series is available in 250 V.a.c. and 275 V.a.c. (VDE 0565-1 safety mark only) ratings, the latter being recommended where mains transients are greater and more persistent than normal. The structure is self-healing for long-term reliability. The epoxy resin case is non-combustible and provides excellent humidity resistance, The ranges extend from 0,01 µF to 0,47 µF. Interference suppression is a popular application for the **WIMA MP 3.** In a nutshell, another cost-effective and supremely reliable capacitor from **WIMA.**

WIMA®

Representatives for USA (excluding Southern California):

THE INTER-TECHNICAL GROUP INC.
WIMA DIVISION
P.O.Box 23 · Irvington
New York 10533 · (914) 591-8822

And for Southern California:
TAW ELECTRONICS INC.
4215 W. Burbank Blvd., Burbank
California 91505 · (213) 846-3911

®Registered Trademark of Company

WILHELM WESTERMANN · Spezialvertrieb elektronischer Bauelemente · P.O.Box 2345 · D-6800 Mannheim 1 · Federal Republic of Germany

Circle 40 on reader service card

droservice group, which has diversified interests including engineering, is purchasing technology for the IPL 4460 from IPL Systems, Waltham, Mass.

What made the secretariat's decision to seek foreign technology unusual was a recent ruling that authorized three other Brazilian groups to develop minicomputers based on 32-bit microprocessors from in-house technology [*Electronics,* May 31, 1984, p. 68]. Included in this program was the state-run computer manufacturer Cobra Computadores e Sistemas Brasileiros SA, of Rio de Janeiro, which makes minicomputers and microcomputers.

Not ready. None of these 32-bit minicomputer projects is anywhere close to launching a product. Now they will have to compete for the low end of the 32-bit minicomputer market with the imported machines, since the four groups authorized to use foreign technology will begin by importing systems and gradually increase the amount of components produced locally.

Besides coming onto the market first, these machines will also be cheaper and more powerful. As one industry observer put it, "the VAX alone will blow the supermicros [the native-technology 32-bit machines] out of the water, particularly as the presence of Bradesco in the group will afford them ample leasing facilities." As a result, the original three developers of supermicrocomputers will have to get back to SEI with their own superminicomputer projects, including proposals for purchasing technology on the international market.

Cobra, which has had numerous financial problems and presumably will wind up under control of the government's National Economic and Social Development Bank, may well acquire technology from AT&T. Also in the market for superminicomputer technology are SID Sistemas de Informacão Distribuida SA, in Curitiba, which has ties to Sharp Corp. in Japan, and Labo Eletronica SA, a São Paulo minicomputer manufacturer that industry sources regard as the weakest of the group financially because of its computer-leasing obligations.

Meanwhile, SEI has told another of the contenders, Edisa Eletronica Digital SA, in Porto Alegre, that its project for a superminicomputer based on Fujitsu's V870 machine is not of interest. The machines SEI wants Edisa to make are in Fujitsu's M series, compatible with IBM's 4300 series. **–Rik Turner**

TELECOMMUNICATIONS

IBM adds to its SBS stake to slug it out with AT&T

Washington, D.C.—IBM Corp.'s plan to buy an additional stake in its Satellite Business Systems communications venture will enable the computer giant to compete more effectively with arch-rival AT&T Co., say industry analysts and market watchers.

As for the technology-rich but profit-poor SBS, its immediate prospects are expected to remain unchanged, although the recent lifting by the Federal Communications Commission of a ban on joint marketing with IBM should help the telecommunications firm's struggle to achieve profitability [*Electronics,* Sept. 22, 1983, p. 97]. Says SBS president Stephen B. Schwartz: "There are not going to be any new twists in our strategy as a result of the ownership change."

Formed in 1975, Satellite Business Systems, of McLean, Va., started life as a partnership between IBM, Communications Satellite Corp., and Aetna Life and Casualty Co., each with a one-third interest. Funded to the tune of over $1.25 billion, SBS has yet to turn a profit.

Apparently uneasy over its ownership position and the drain on its financial resources, Comsat now wants out of the money-losing opera-

3μ CMOS Double Poly and Double Metal

NOW COMDIAL

Prototyping, Production

Double metal prototyping and preproduction volumes. Double poly prototyping in 15 days and full scale production volumes. To talk prototyping or volume production, call Gary Kennedy, Vice President and General Manager, at (408) 744-1800. And ask him about our complete wafer testing capability. Prototype – Volume – Test. Comdial has it all.

COMDIAL

Technology Division
Semiconductor Services

U.S.
1230 BORDEAUX DRIVE
SUNNYVALE, CALIFORNIA 94089
TELEPHONE (408) 744-1800
TWX (910) 339-9307

EUROPE
J. PORTLOCK
EXPOTECH
TELEPHONE (UK) 0608 737501
TELEX 838 785 TOBY G

Circle 41 on reader service card

TEK DISTRIBUTION UPDATE

METERMASTER TO MARKET TEK 2200 SCOPE LINE

BEAVERTON, OREGON—Tektronix, Inc. has expanded its distribution channels with the addition of Metermaster Corporation as a distributor for the 2200 Series of portable oscilloscopes.

Metermaster, a subsidiary of Kierulff Electronics Corporation, is the West's leading test equipment distributor, with offices nationwide. In a first-year pilot program, Metermaster's Los Angeles, San Diego, Palo Alto and Phoenix sales offices will be marketing the 2213A, 2215A, 2235 and associated accessories.

According to Bill Stephens, Manager of Alternate Distribution Channels for Tektronix, "Metermaster was chosen to distribute Tek products on the basis of its reputation for reliability and integrity, in addition to being one of the few distributors for higher-end and some automated test equipment."

He cited fast delivery, single-source convenience, flexibility in credit terms and quality support as benefits that customers purchasing Tek products from Metermaster should appreciate.

Dave Donovan, Metermaster Marketing Director, said the move will help Tektronix reach instrument users traditionally served by distributors. "This is an excellent opportunity to offer our customers the best and most technically sophisticated products available."

Metermaster joins EIL Instruments, Inc. as one of Tek's two outside distributors. Of course, the 2200 Series products will continue to be available from Tektronix sales engineers.

For more information, write on company letterhead to the Marketing Communications Department, Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077.

Copyright © 1984, Tektronix, Inc. All rights reserved.

Tektronix®
COMMITTED TO EXCELLENCE

Circle 42 on reader service card

tion. It has agreed to sell its SBS stake to both IBM and Aetna for a price that was undisclosed by the principals, but estimated by market watchers at about $60 million. IBM plans to buy 80% of Comsat's interest, giving the Armonk, N.Y., firm about 60% of SBS.

Schwartz doesn't think the move reflects any grand design on IBM's part. "Remember, it was Comsat who wanted out. . . . IBM wasn't itching to buy," he notes.

Strategic importance. Nevertheless, IBM's willingness to take on 60% of the SBS burden is a "strategic move vitally important for the company's future growth," insists Thomas J. Crotty, chief IBM watcher for the Gartner Group, a Stamford, Conn., market research firm. "Just as AT&T is trying to become a big leaguer in the computer business, IBM is planning for a major thrust into telecom markets," he adds.

In fact, IBM so values telecommunications technology and expertise that Crotty expects to see the firm eventually acquire Aetna's share and thus take over SBS entirely. An IBM spokeswoman denied that the firm is entertaining that idea and refused to comment on speculation regarding SBS's role in IBM's strategy.

For now, IBM's majority stake in SBS ensures it of a capability it will need to stay competitive in years to come, observes Frederick Ziegel, a telecommunications industry analyst with the New York brokerage firm of Salomon Brothers. IBM already has the lead in data-processing technology, he says. Its agreement with Rolm Corp., a maker of private branch exchanges in which it has a minority interest, also gives IBM a direct route for marketing interoffice networking services.

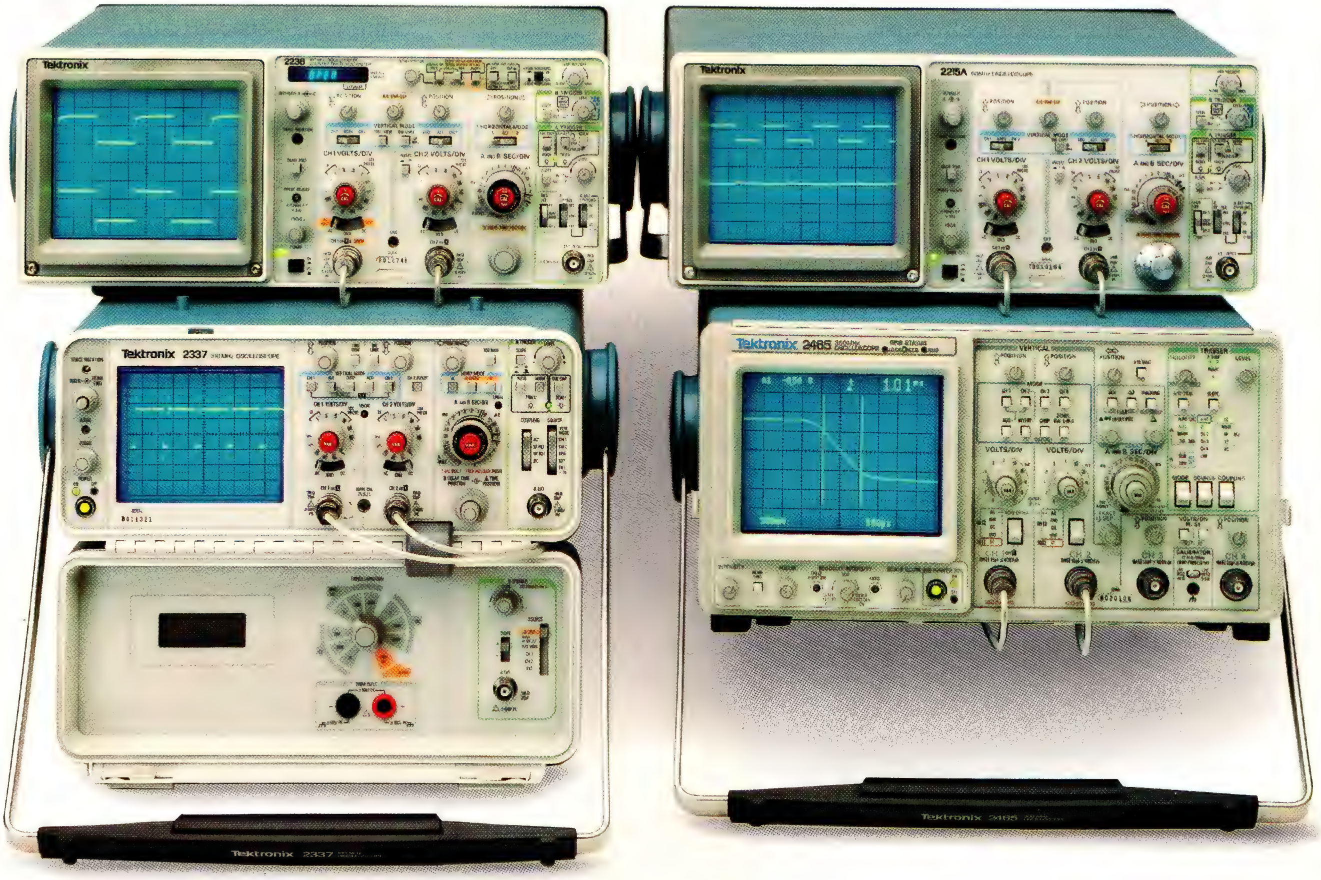
With SBS's wide-area digital transmission system and experience in building private voice-and-data networks, IBM can now craft itself as a true vendor of the office of the future, Ziegel explains. It can court customers with both Rolm and SBS at its side and sell one-stop shopping for computer and telecommunications services and equipment.

Buyers are particularly sensitive to that pitch in light of the confusion and chaos that has trailed the breakup of AT&T, Ziegel notes. Customers want one firm to supply it all—

TEK 2000 FAMILY OSCILLOSCOPES

THE ANSWER BY ANY MEASURE

High performance portable scopes. One name says it all!



A world standard in performance plus value: the Tek 2000 family of portable scopes. Each one has different characteristics but they have plenty in common: quality that's unmistakably Tektronix. In our 30 years of oscilloscope leadership, no other scopes have recorded such immediate popular appeal.

Even compared to Tek's own previous industry standards, these scopes are easier to use, more portable, more precise. You get better measurements faster, more performance for the money.

There's a full family of scopes to fit demanding portable needs. At 60 MHz, choose the 2213A or dual time base 2215A. At 100 MHz, the 2235 or 2236 with its bright fluorescent readout and integrated counter/timer/DMM. For field service environments, the ultra-durable, 100 MHz 2335, 2336 or 2337, built to be rugged and reliable beyond all previous standards.

Finally, there are the 150 MHz 2445 and 300 MHz 2465: the leading edge in portable scope performance. Now you can specify either with built-in GPIB interface for automated measurements and a powerful TV option for precise video measurements.

Contact the Tektronix office or sales representative nearest you for complete details. Each scope is backed by a 3-year warranty, excellent documentation, training programs, plus applications and service support worldwide. All part of the high standard of excellence to expect when you work with Tektronix, the world's largest and most respected scope manufacturer.

Tektronix®
COMMITTED TO EXCELLENCE

Copyright © 1984, Tektronix, Inc. All rights reserved. TTA-453

the hardware, software, maintenance, and service, he adds. In view of these potential opportunities, IBM may be more than willing to sink additional money into SBS and see it run in the red for a few more years to secure a strong position in this market, industry watchers believe.

With IBM looming larger in the picture, SBS can now count on deep pockets to finance its growth. It expects $200 million in financing this year, with the same amount already committed for 1985. It can also look forward to IBM's flexing its marketing muscle to sign on new customers for its private and public switched network services. However, money and marketing savvy won't turn the tables for SBS, believes Gary Tobin, a spokesman for competitor MCI Communications Corp.

"SBS has had IBM as a partner for 10 years. It didn't help them to garner market share then and it won't now," he says. SBS's primary problem, according to Tobin, is that it has the wrong technology—high-speed digital transmission by satellite—for competing in the most lucrative part of the business, namely voice-grade communications. For distances under 1,000 miles, satellites are both ineffective and inefficient, he claims.

SBS prospects. Unless SBS brings in a new partner who offers either a huge customer base, such as a bank, or existing terrestrial facilities, such as an independent telephone company, Tobin sees little chance of it expanding much beyond its 1% share of the long-distance telephone market. The race for customers that stems from the phasing in of competition in the long-distance-telephone business is a "one-shot opportunity that will be over by September 1986," he claims.

Indeed, SBS's Schwartz reports that IBM and Aetna are seeking a third investor "who could greatly enhance our service offerings." In addition, it has plans to augment its system with fiber-optic, microwave, and cable links to expand its Skyline voice service from 20 cities to 40 by year-end, and to 200 cities by 1988. By then it hopes to have a 4% to 5% share of the $40-billion-a-year voice market. "Our goal is to differentiate ourselves as a supplier of high-quality voice circuits to businesses that can later manage their growth into [needing] a variety of nonvoice services," observes Schwartz, who is a former IBM executive. – **Karen Berney**

SEMICONDUCTORS

Cell array speeds peripheral's debut

Austin, Texas—Purveyors of semicustom logic arrays have been touting them to their equipment-manufacturing customers as a slick way to get new products on the market fast. And what's good for customers is also good for chip makers, in the view of Motorola Inc.'s Microprocessor Division.

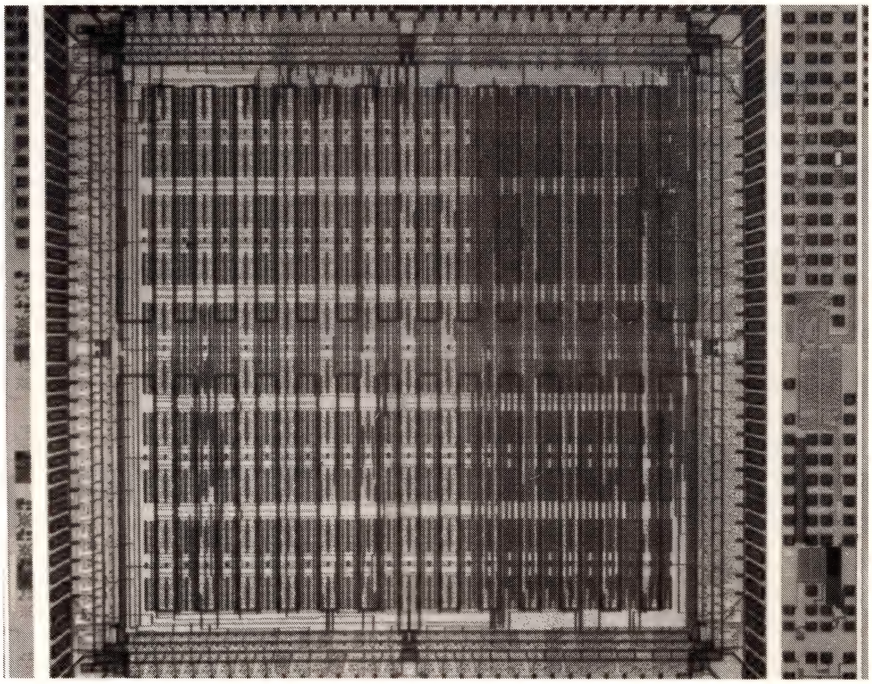
To accelerate the design of its first memory-management peripheral supporting the new 32-bit 68020 microprocessor [*Electronics*, July 12, 1984, p. 46], Motorola has called into service a macrocell array carrying the equivalent of 2,800 gates.

Use of the bipolar MCA2800ALS array has allowed Motorola to ready its MC68461 peripheral in a matter of months instead of the two years it usually takes to design an equivalent circuit, says James Lovegrove, spokesman for the firm's high-end microprocessor operation here. As a result, the 68461 memory-management controller will be available to customers in the fourth quarter as deliveries of the 68020 microprocessor are stepped up.

From scratch. At the same time, a more powerful paged-memory-management unit—designated 68851—is being designed from the ground up using high-speed complementary-MOS technology. It should be available in the second quarter of 1985.

Until then, 68020 customers requiring memory management can use the array-based 68461, which utilizes the most-used subsets of the paged-memory-management unit and can be mounted on a "mezzanine" motherboard having the same footprint as the more powerful chip.

For the design of the memory-management controller, Motorola recently repeated the strategy it used to hasten the introductions of two 16-bit microprocessor peripherals, the MC68452 bus-arbitration module and the 68153 bus interrupter. The bus-arbitration module [*Electronics*, Nov. 17, 1982, p. 197] was created from a 500-gate macrocell array, while the 40-pin, 8-register bus-interrupter module [*Electronics*, April 7, 1983, p. 176] was made from a 1,300-gate array.–**J. Robert Lineback**



Accelerator. This cell array, which has the equivalent of 2,800 gates, dramatically speeded up the introduction of Motorola's memory-management chip for its new 32-bit microprocessor.

now... WHAT THIS COUNTRY NEEDS IS A GOOD 5¢ *ultra fast switching* RECTIFIER*

HERE IT IS...GENERAL INSTRUMENT'S *ultra fast switching* UF4002

The UF4002 ultra fast switching rectifier has reverse recovery time less than 50 nanoseconds! Plus other excellent features:

- Low forward voltage — less than 1.0 volt at 1.0 ampere
- 30 ampere surge capability
- Forward recovery time less than 25 nanoseconds
- Available in UF4001 thru UF4004, PIV50-400 volts with I_R less than 10 μ amps
- For higher current operation use our 3 ampere UF5400 thru UF5404 series.

***Conditions of Sale:**

Minimum order quantity 50,000 units scheduled within 60 days. Minimum shipment 25,000 pcs.

Packaging: 1,000 units per box, or 5,000 units per reel.

Marking: Cathode Band, UF4002, GI.

For complete technical data, information on immediate product delivery, or the latest General Instrument catalog, contact your authorized distributor or:

General Instrument Corporation,
Discrete Semiconductor Div.
600 West John Street,
Hicksville, NY 11801, USA
(516) 933-3333

GENERAL INSTRUMENT

Circle 45 on reader service card

SR&D

NEURON

NOW TWO SUPER CHOICES!

A New Magnetic Card Reader/Writer with RS232C Interface for Direct PC Connection.

Model ACT-670-3A
Reader/Writer

Model ACT-270-1R
Reader

SRD gives the popular NEURON family a fresh dimension with the RS232C interface-equipped ACT-670 Magnetic Card Reader/Writer. Motor-drive ease and speed blend with superb performance to match diverse needs. The compact ACT-270, an economical read-only manual unit with RS232C interface, is also available.

Advanced SRD technology achieves extraordinary reliability and cost performance. Every member of the NEURON family is designed for lightweight handling ease, minimal power consumption and dependable long-life service.

Contact us today for complete information on the new ACT-670 and entire NEURON family.

S R D CORPORATION

SRD USA Office
2250 E. Imperial Highway,
Suite 252,
EL Segundo, CA 90245-3501
Tel: 213/417-5114
Telex: 664474 SECIMP

Marume Bldg., 3-7-16
Iwamoto-cho,
Chiyodaku, Tokyo 101, Japan
Tel: (03) 863-0051
Fax: (03) 866-7486
Telex: 265-5008 SRD CO J

Circle 46 on reader service card

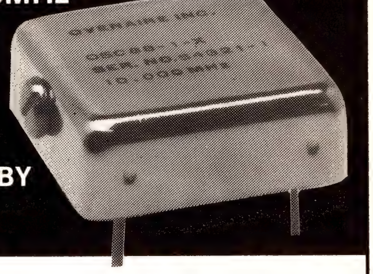
NEW FROM

ovenaire

LOW PROFILE
PCB MOUNT 10MHz
TCXO

ONLY 1.2 CU. IN.
VOLUME

1.50 IN. SQUARE BY
0.53 IN HEIGHT



Features a low aging crystal with excellent ambient stability and logic output. Also features built-in voltage regulator and a piston trimmer to correct for long term crystal aging. Several options on temperature range and stability.

FAST PROTOTYPE DELIVERY
FOR DETAILS CALL ANDY BELL 804-977-8050

OVENAIRE-AUDIO-CARPENTER
706 Forrest St. Charlottesville Va. 22901
804-977-8050 TWX510-587-5461

Circle 105 on reader service card

Ever notice how some people always seem to have the right answer? No matter what the situation, they always seem to be a step ahead.

And they're successful...the first in line to lead an important project...the first in line for a promotion. It's certainly not magic. Usually it's a combination of hard work, brains, guts and desire.

It probably means they read ElectronicsWeek... regularly.

ElectronicsWeek has helped propel many a manager and engineer to the front line...to the "leading edge" of the industry. And just as we've been providing many of your colleagues with the right information, the *important* information–when they need it most–so too can we provide it for you.

Every week an ElectronicsWeek subscriber receives an issue crammed with the latest information on new products, developments, concerns and trends in the worldwide electronics industry.

When you become a subscriber, we'll supply you with the intelligence you need to make the big decision, or the every day decision to further your career and reap profits for your company. For a taste, just browse through the issue you're holding.

But, you really don't have to believe us. Just ask the person who's always a step ahead.

To become a subscriber, just complete and mail the insert card in this magazine. If subscription card is missing, write: Circulation Manager, ElectronicsWeek, P.O. Box 511, Hightstown, N.J. 08520.

ElectronicsWeek
The Voice of the industry

McGraw-Hill

San Fernando Electric Division is your instant source for Hi-Rel MIL-Spec MLC capacitors and filters.

We deliver while others promise. You can have off-the-shelf delivery of most military capacitors. Our team of 20 distributors and 30 stocking locations gives you nationwide availability.

QPL reliability.

Select the reliability level you need—available now.

- MIL-C-39014 capacitors in stock:
  CKR 04, 05, 06, 07, 08, 11, 12, 13, 14, 15, 16, 17, 18, 20, 22, 23 ("S" level)
  CKR 24 ("M" level)
- MIL-C-20 capacitors in stock:
  CCR 05, 06, 09 ("S" level)
  CCR 07, 08, 75, 76, 77, 78, 79 ("M" level)
- MIL-C-55681 capacitors in stock:
  CDR 01, 02, 03, 04, 05, 06 ("S" level)

Standard and custom filters.

Our mini-filters are qualified to MIL-F-15733. Single and three-phase custom filters are designed and manufactured to your requirements.

Service second to none.

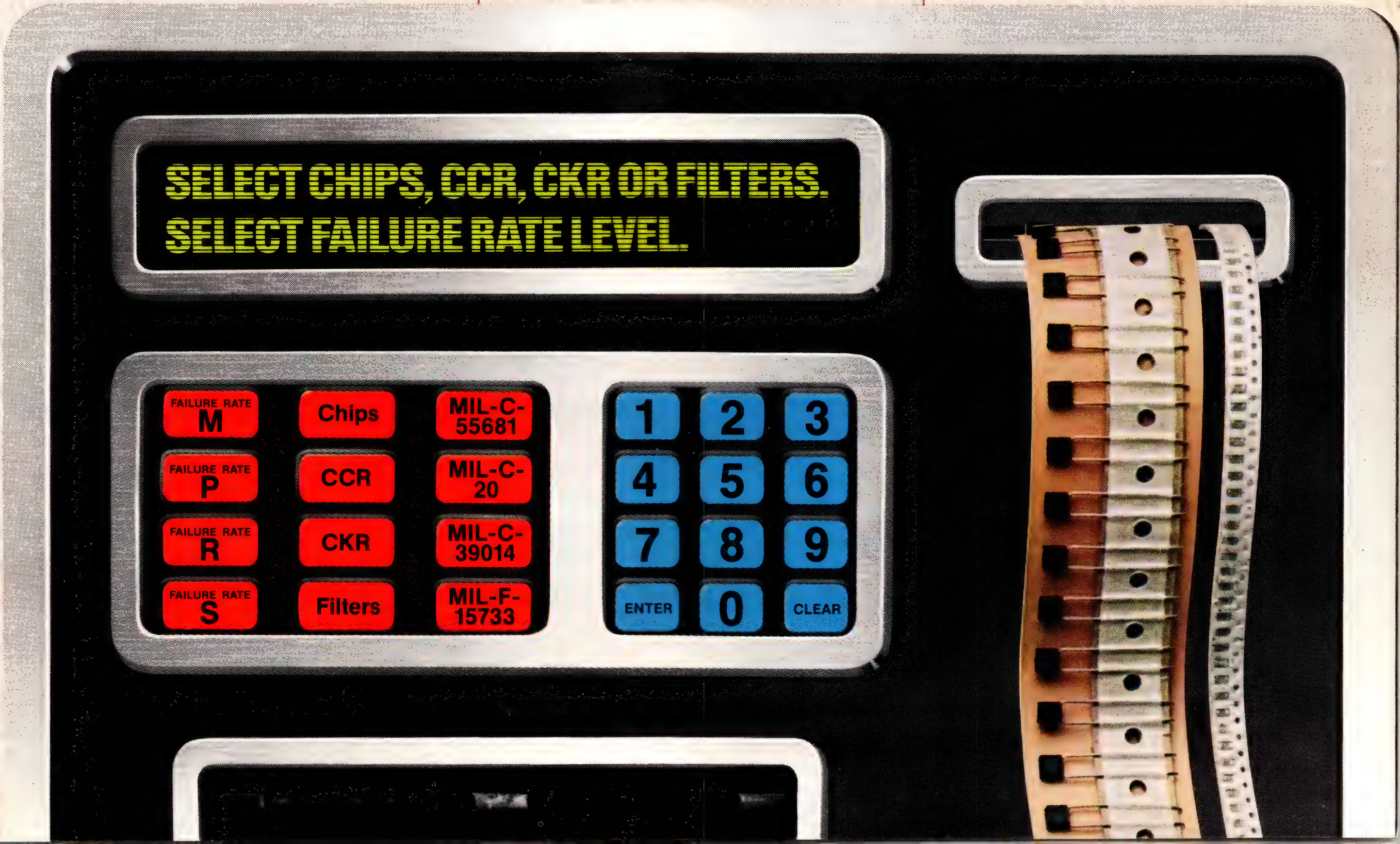
You can choose from a full range of established reliability (ER) MLCs and filters. We can provide you with our proven "NiBar" barrier-end termination to endure the most demanding soldering temperatures, chips with marking identification and tape-and-reel packaging for automatic insertion.

Write to SFE Technologies, San Fernando Electric Division, 1501 First Street, San Fernando, CA 91340-2793. Or call Ron Marhevka, our General Sales Manager, at (818) 365-9411. In Europe contact SFE Technologies Europe B.V., Wilton-Straat 11-13, 2722 NG Zoetermeer, The Netherlands, Tel. 079-413231.

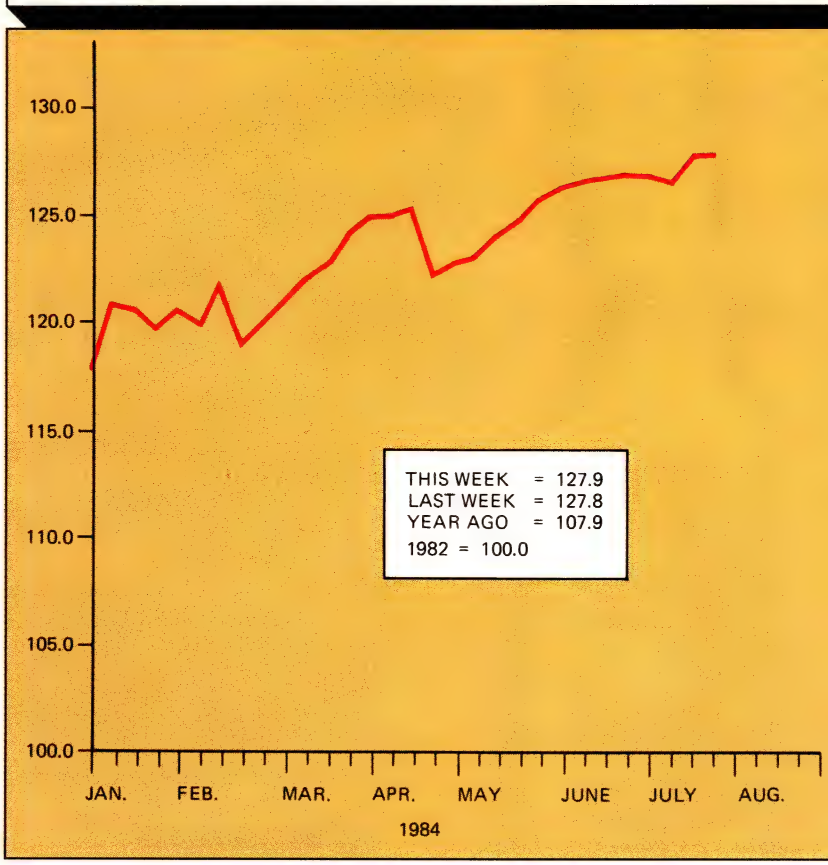
We deliver. Others promise.

SFE
TECHNOLOGIES
San Fernando Electric Division

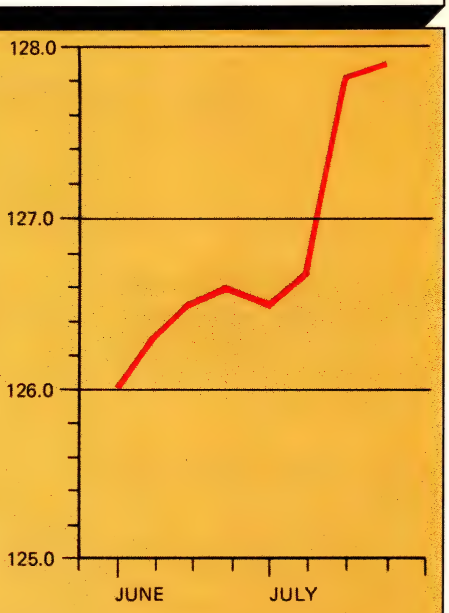
Circle 47 on reader service card



ElectronicsWeek Index



THIS WEEK = 127.9
LAST WEEK = 127.8
YEAR AGO = 107.9
1982 = 100.0



The *ElectronicsWeek* Index, a seasonally adjusted measure of the U.S. electronics industry's health, is a weighted average of various indicators, including imports, exports and production of products.

U. S. ELECTRONIC COMPONENTS PRODUCER PRICE INDEX (1967 = 100)

	June 1984	May 1984	June 1983
Digital bipolar integrated circuits	62.9	63.2	62.6
Digital MOS ICs	43.4	44.0	41.3
Linear ICs	66.0	64.2	63.0
Capacitors	190.4	191.8	192.7
Resistors	181.6	182.9	184.8
Relays	319.1	303.0	234.4
Connectors	228.5	226.9	220.9

U. S. GENERAL ECONOMIC INDICATORS

	May 1984	April 1984	May 1983
Index of leading economic indicators	168.2	168.3	154.4
Budgeted outlays of the federal government ($ billions)	71.391	68.687	63.040
Budgeted outlays of the Department of Defense ($ billions)	19.955	18.711	17.309
Operating rate of all industries (% capacity)	80.0 (June 84)	79.9 (May 84)	73.7 (June 83)
Industrial-production index	163.6 (June 84)	162.8 (May 84)	146.4 (June 83)
Total housing starts (annual rate in thousands)	1,900 (June 84)	1,805 (May 84)	1,743 (June 83)

TI is making it happen with VHSIC.

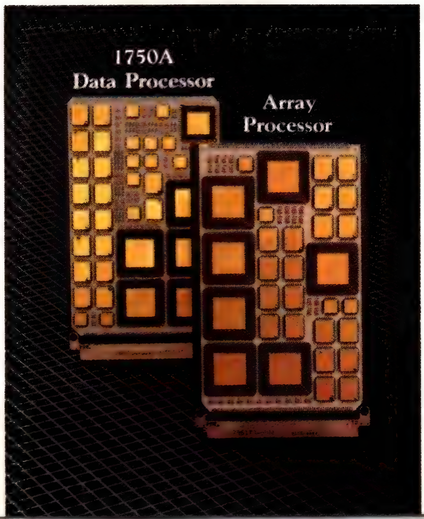
Yes, Texas Instruments is making the future happen now with VHSIC.

The first fully functional 1.25-micron VHSIC chips, operating at 25-MHz over the full military temperature range, have been delivered to the U.S. Army. Functional devices have also been delivered to the U.S. Navy, U.S. Air Force, and Defense Nuclear Agency for test and evaluation.

Current DoD funded insertion programs at TI include Pave Pillar 1750A; ICNIA; ITARS; LHX; M-1 Fire Control; and weapon guidance for IR Hellfire/JSS, TOW 2, and the Launch-and-Leave Glide Bomb. VHSIC technology at TI is also being expanded to include 0.5-micron geometries for application to future autonomous guided weapons for the Army, Navy, and Air Force.

TI is a DoD prime contractor for VHSIC Phase I development, Phase III R&D activities, the Phase II Submicron Definition Program, and is teamed with Intermetrics and IBM for the VHSIC Hardware Design and Development Language (VHD^{2}L) Program.

TI is truly making it happen now with 1.25-micron VHSIC chips and will continue to make it happen through the successful development of the Submicron Development Program.



TEXAS INSTRUMENTS

©1984 Texas Instruments 27-3431

Circle 49 on reader service card

HOW WE TOOK A DRIVE OVERSEAS.

Over five years ago, Tandon made one of the boldest moves in the drive industry when we established manufacturing and assembly facilities overseas.

It was all part of our commitment to toss protocol aside, break the rules and do anything possible to make a better drive at a lower cost.

Well, just look where it got us.

Now we're all over the world. Our prices have dropped by more than half. We've made quality control an art form. We're keeping up with the highest volume product demands without a hitch.

Of course, not everything is going overseas. We've been rather judicious about selecting the right tasks to make the move.

And happily, our manufacturing success over there has made for some important achievements over here, too. We've kept our most advanced technology and research and development at home where it belongs. Right where we have a large, stable, experienced group of high-tech experts.

As a result, we're stronger than ever.

So now when you look at drive companies, there's one other characteristic you should keep in mind.

Foresight.

At Tandon, it's never been a foreign idea.

Tandon

THE DRIVING FORCE BEHIND THE SMALL COMPUTER INDUSTRY.

Tandon Corporation, 20320 Prairie, Chatsworth, CA 91311. (818) 993-6644, TWX: 910-494-1721, Telex: 194794. Regional Sales Offices: Boston (617) 938-1916 • New York (201) 851-2322 • Atlanta (404) 934-0620 • Chicago (312) 530-7401 • Dallas (214) 423-6260 • Irvine (714) 669-9622 • Santa Clara (408) 727-4545 • Frankfurt, West Germany 6107-2091, Telex: 411547 • London, England (0734) 664-676, Telex: 848411. Distributors: Hall-Mark, Kierulff, Schweber.

Circle 51 on reader service card

BOMBAY
SINGAPORE
TAL HO

Washington Insight

CUTTING MILITARY BUDGET WITH WEAPONS THAT WORK

Quarrels between presidential candidates about military spending have been a part of the election process almost since the beginning of the republic. But if two Air Force generals are any measure, the candidates will have less to say about how many weapons the country is buying, and more about how well those weapons should work.

There is much talk these days about poor performance by weapon systems. Responsibility lies as much with the military as it does with industry contractors, inasmuch as the military customer indirectly encourages producers to promise more by way of performance than they know they can deliver. "We overspecify while contractors overpromise and underprice," says one Air Force colonel. Additionally, inventory shortages of spare parts in complex systems is handicapping readiness—but that's not all there is to the problem, as the two Air Force leaders attest.

For example, that colonel's boss, Lt. Gen. Thomas McMullen, sees a vital dollars-and-cents aspect from his perspective as commander of the Aeronautical Systems Division at Wright-Patterson Air Force Base, Dayton, Ohio. One of his concerns is the problem of premature decisions in writing specifications and selecting contractors for communications subsystems that must be integrated into an aircraft later. Those early, and generally costly, choices trouble McMullen. The job of integrating avionics on a new plane holds little appeal for most electronics technologists. But McMullen suggests that industry cultivate an interest, and quickly. "We just can no longer live with integration costs that exceed avionics subsystems costs," he warns.

Another concerned Air Force officer, Gen. James P. Mullins, who also operates out of Wright-Patterson as commander of the Logistics Command, comes on strong about the economics of keeping systems available once they become operational. Mullins argues that "there is a practical way for the Air Force to have the capability of fulfilling all of its military commitments, anywhere in the world, at any time, for billions [of dollars] less."

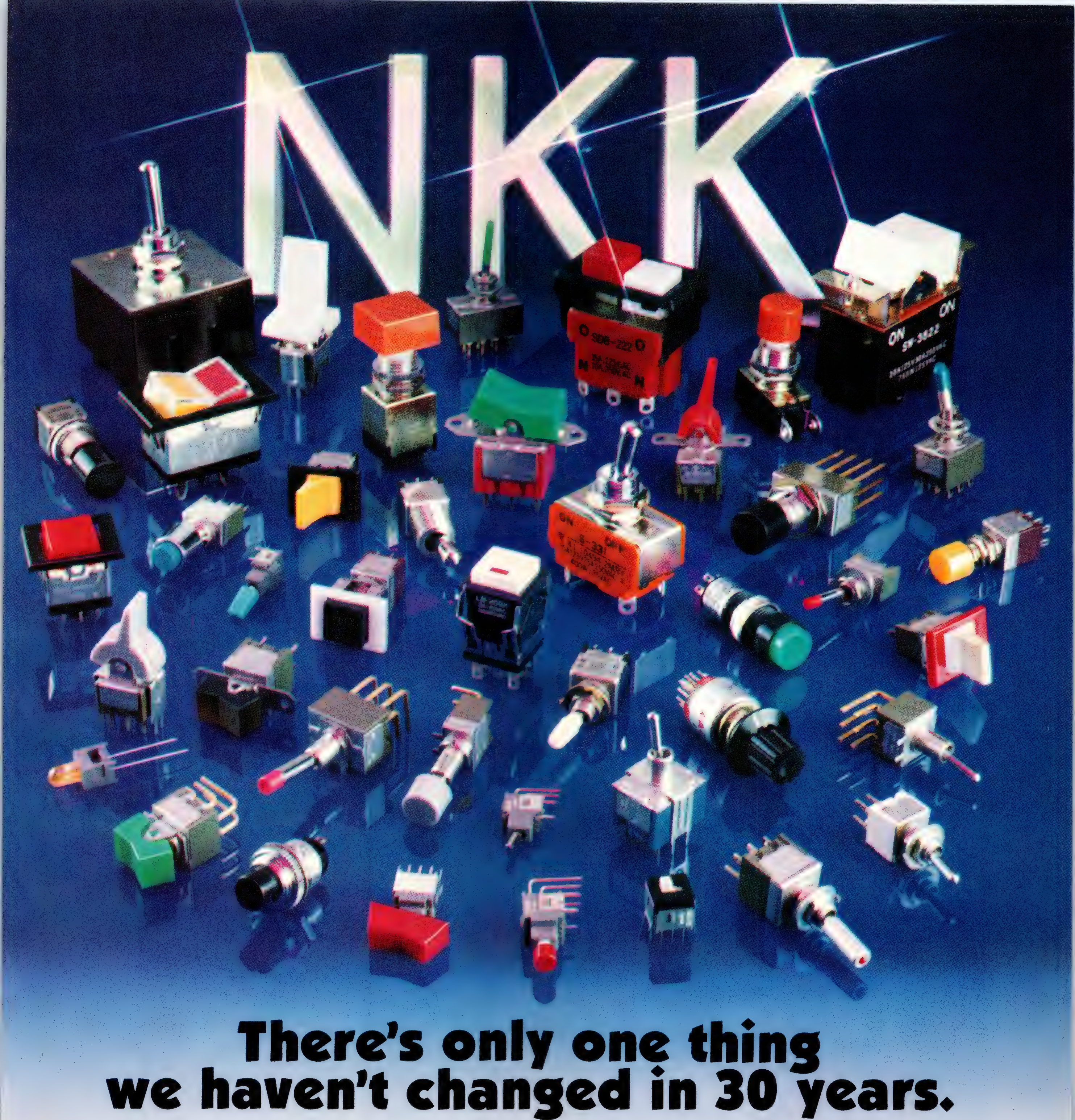
The Mullins solution is particularly applicable to electronics, he says, provided the country and the Air Force can rid themselves of the mindset that has led the nation into accepting lack of reliability as an inherent given of high-technology weapons systems. More than anything else, argues the general, "that mindset is responsible for our designing systems to go fast and high, but not to do so reliably for any length of time."

Citing the four factors used to measure a system's wartime effectiveness—launch success, system reliability, penetration probability, and probability of kill—Mullins says reliability is the single most limiting factor. One consequence of unreliability, he points out, is that "instead of sending one airplane to do a particular job, we'd often have to send several."

When a composite of fighters and their spare-parts requirements is modeled around their mean time before failure, Mullins points out, a 25% improvement in MTBF from 500 flight hours to 625 would cut spares requirements by almost 40%. "If you could double the present MTBF, you would eliminate almost 80% of the present spares requirement."

The technology for significantly increasing MTBF is already in hand, he contends, noting that predicted failure rates in the home-computer market of 1% over a product's lifespan are being claimed for some systems. Considering that neither general is a candidate for anything, the message deserves more than usual attention.

–Ray Connolly



There's only one thing we haven't changed in 30 years.

Our quality. We developed the first super-subminiature washable switches, the first 10-amp rated miniature toggles and the first miniature lighted snap-in rockers — just to name a few. But while innovation became an NKK trademark, quality remained a tradition.

Today, you'll find that quality in over 477,000 different switches. In fact, we can offer you just about every type of switch you'd expect from a major manufacturer, plus a lot you won't find anywhere else.

Send for our 50-page catalog, then compare the performance specs, construction materials and standard features of our switches with those of the ones you are now using. You'll see why, dollar for dollar, NKK is the standard of comparison.

We put our 30 years of experience to good use — just so you could do the same.

See us at MIDCON/84 9/11-13
Booth #1333-1335

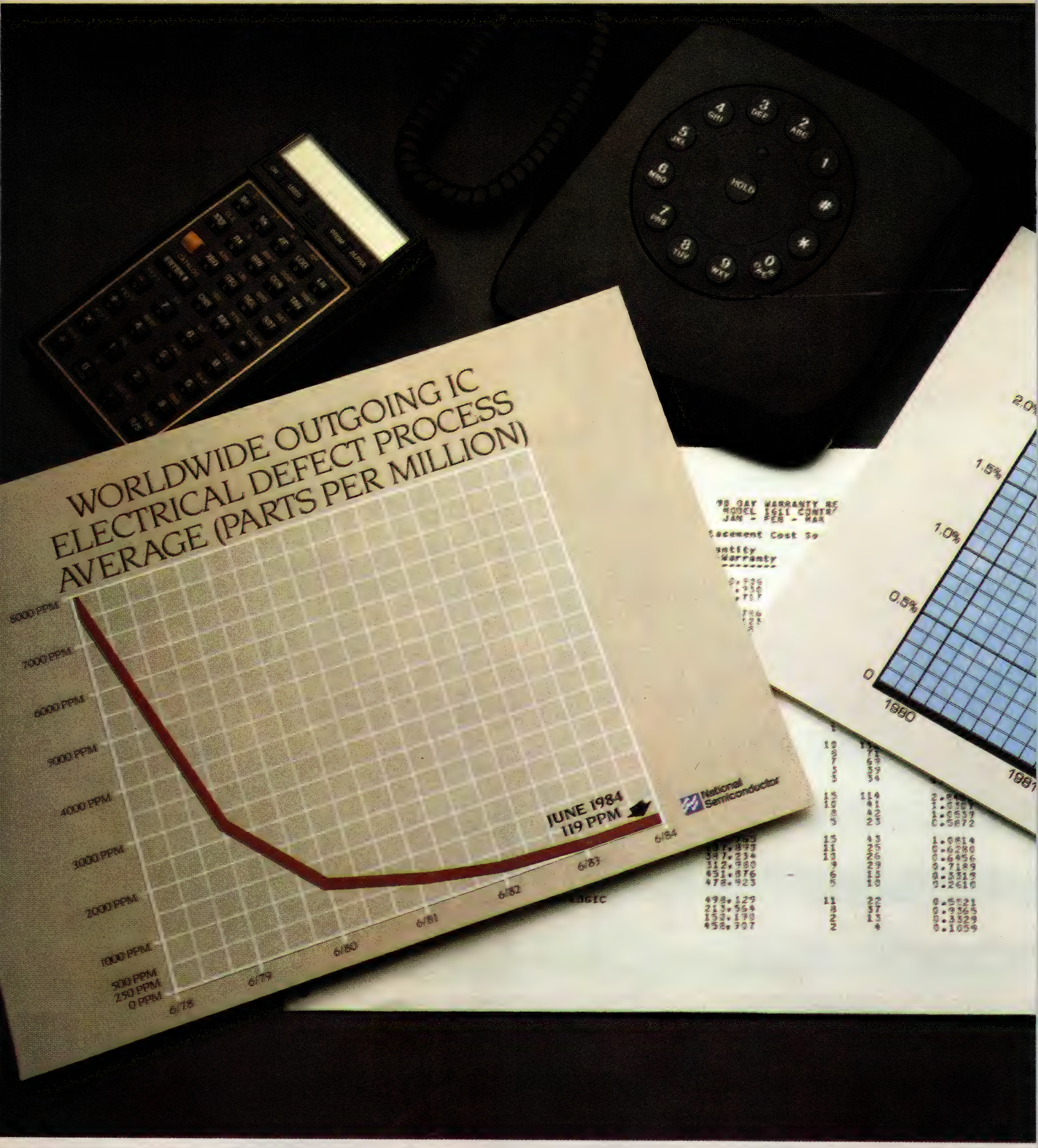
NKK nikkai

NKK switches
OF AMERICA INC.

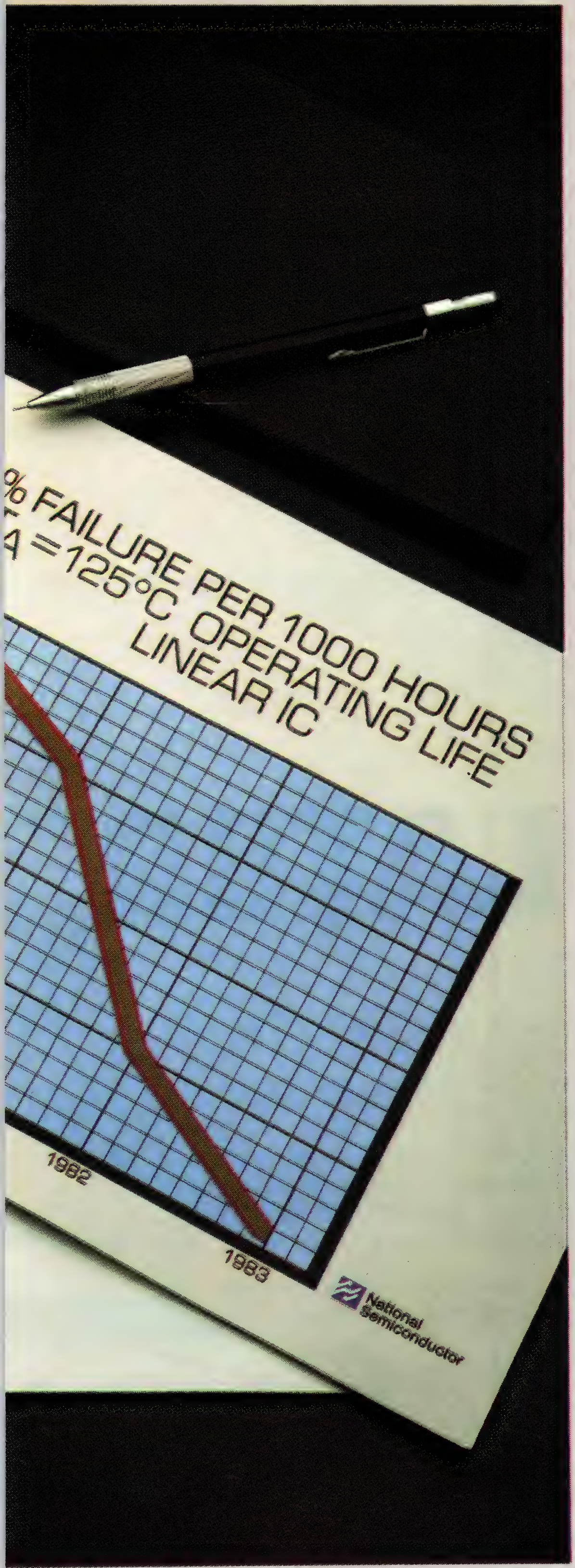
14415 N. Scottsdale Road, Suite 600, Scottsdale, AZ 85260 (602) 991-0942. TWX 910-950-1167.
In Canada contact: Canadian General Electric Co., Ltd., 189 Duffern Street, Toronto, Ontario M6K 1Y9 (416) 537-4481.

Circle 53 on reader service card

R=$^{Q}/_{T}$. THE DEFINITION OF RELIABILITY IS QUALITY OVER TIME.



1983. National redefines quality. And then redefines it again. 1984. Now, National defines reliability.



Everyone is talking about quality. But at National, we give you quality you can rely on year after year. That's reliability.

In the last two years, National has twice redefined the industry's standards for quality.

By 1983, after only four years, we dropped from 8,000 ppm to a mere 174 ppm. Then we went even further. To 119 ppm.

And now we're doing the same in a different, but no less critical area. Reliability.

Quality is important because it measures how well a product will perform. But you also need to know how long it will perform. Because the more reliable our components, the more reliable your product. And, of course, the less you spend on warranty claims.

The chart on the left illustrates what we've done. It measures reliability as a Linear IC failure rate tested under severe conditions. The 1,000-hour test is equivalent to 20 years of operation under normal usage. Ours has plummeted from 2.0% to just 0.15%. That's an exceptional 92.5% reduction in our failure rate.

Results like these don't happen overnight. They happen over time. And at National it started with our people.

They're responsible for the quality and reliability of our products at every stage of development —from the very start to final shipment.

We've developed a Fast Reaction Program that catches latent defects before they ever leave a National plant. More importantly, feedback for corrective action solves the problem once and for all.

We've developed corrosion prevention techniques. Automated manufacturing lines to all but stop unit defects. Statistical quality control. The list goes on.

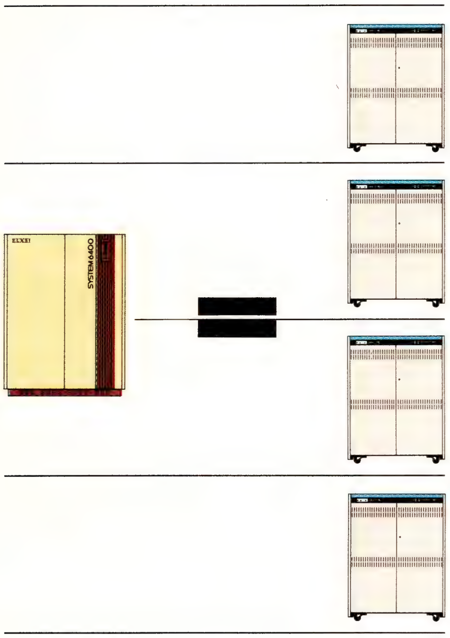
And so does our commitment to the most important service we can provide: delivering you exceptionally superior products, time after time.

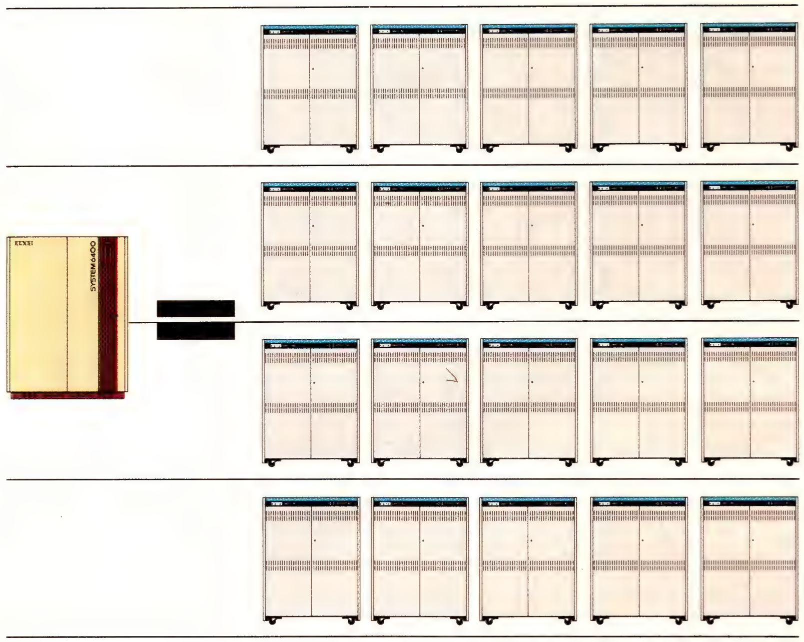
Remember, National gives you the quality you've come to expect. And the reliability you'll come to depend on.

National Semiconductor
We're doing it.

Circle 55 on reader service card

ELXSI vs. VAX





NOW OR LATER

Unmatched performance, deliverable now, and potential for expansion. That's ELXSI.
The ELXSI System 6400 with one CPU has 4 times the performance of the VAX 11/780. Plus you can add up to 5 CPUs in the initial cabinet, and deliver 20 times VAX performance.
10 CPUs in two cabinets. Now. Or later.

The 64-bit multiprocessor System 6400 offers a choice of either EMBOS, our proprietary message-based operating system, or ENIX, our virtual memory UNIX System V operating system.
You can choose either one or both. All configurations feature 32, 64, or 80-bit floating point arithmetic hardware, virtual memory, Ethernet link, the largest physical memory in the business, and more.

The ELXSI System 6400. No one can match our performance or our potential.
Not now. Not later. Contact ELXSI today for complete information.

THE ELXSI GUARANTEE:
find a computer system that can match our performance and our potential for expansion, and we'll raise our price to match theirs.

ELXSI

ELXSI, 2334 Lundy Place, San Jose, California 95131
408/942-1111, Telex 172320.

UNIX is a trademark of Bell Laboratories. Ethernet is a trademark of Xerox Corporation.
VAX is a trademark of Digital Equipment Corporation. EMBOS and ENIX are trademarks of ELXSI.

BINDELS STEERS PHILIPS' ENTRY INTO PERSONAL COMPUTER MARKET

Apeldoorn, the Netherlands

Since Gert Bindels became a managing director at the Philips Data Systems Division here about a year ago, a good part of his time has been spent preparing for its entry into the personal computer market. A company like Philips "must be in the personal computer business," says the 49-year-old Bindels, who heads the division's commercial activities. "[It] has become part of our strategy in computers."

The vehicle that is launching the Dutch electronics giant into the field is the P3100, a 16-bit machine with a random-access-memory capacity of from 128- to 512-K bytes. Introduced at this spring's Hanover Fair in West Germany, the P3100 can be used either as a stand-alone system or as a work station operating with larger computers. It is compatible with IBM Personal Computer hardware as well as its systems and applications software.

"Our short-term goal is to reach the No. 3 spot in Europe," says Bindels. That would put Philips just behind industry leaders IBM Corp. and Apple Computer Inc. Eventually, the Dutch firm will venture abroad into the more competitive U.S. market, "which we certainly cannot do on our own," Bindels says. Just how that might be done, he is not yet prepared to discuss.

To reach its goal in Europe's personal computer market, Philips wants to be price-competitive with industry leaders and plans to adopt a two-channel sales approach. One is a direct channel to large accounts, and the other is an indirect channel to the small end-user.

Also, the company will offer dealers a package, elements of which have already been applied to the marketing of other Philips computer products. The package includes dealer training, guaranteed service, and extensive documentation. Both Philips and its network of personal computer dealers will conduct case studies to determine the best types of software to sell.

With such a package, which Bindels thinks is unusual in the personal computer field, "we want to promote loyalty among our dealers and give them the feeling that they are safe with Philips and its products," he says. "Loyal and committed dealers will guarantee us continuity in the business."

Quick start. Gert Bindels wants to make Philips the No.3 personal computer company in Europe and to do so quickly.

Bindels has two decades in the computer business. With advanced degrees in engineering and economics from two West German universities, he joined the Cologne-based subsidiary of France's Honeywell-Bull in the mid-1960s. He held a top management position there and later a similar spot at the West German small-computer firm of Kienzle Apparate GmbH, in Villingen.

Besides grooming Philips for the personal computer business, Bindels wants to keep the Dutch company in the forefront—and even improve its standing—in other computer fields. In office equipment, for example, he wants his company to be among the top three vendors in major national markets in Europe and the Far East.

In computers for banking, Philips is already No. 2 in many countries. A deal with Control Data Corp, Minneapolis, will make the firms top contenders in optical recording peripherals and associated media for use with computers. **–John Gosch**

Sidney Webb takes on familiar role as acquisitions hound for EM&M

Encino, Calif.

If there is any job that J. Sidney Webb knows cold, it's acquiring electronics firms. During his tenure at TRW Inc.'s Electronics Group—from 1963 until he was promoted to corporate vice chairman in 1978—he bought some 25 companies, building TRW to a near-$500 million operation. Now, following a short retirement since 1981, he is again donning his acquisition pinstripes as board chairman of Electronic Memories & Magnetics Inc.

Webb's mission is a simple one: to expand the $80 million annual sales operation through a policy of acquisitions. Accordingly, his prime focus since his appointment to the post in May has been "figuring out what our strategy should be."

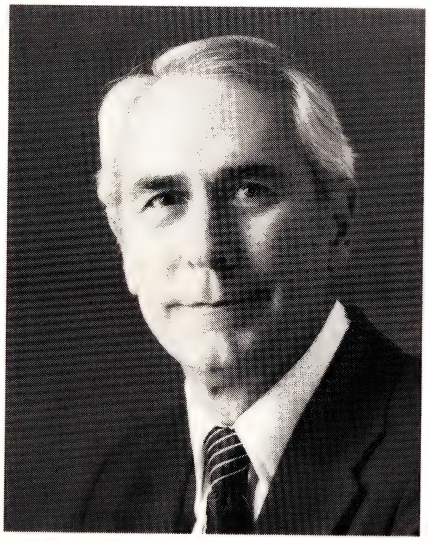
Making the job somewhat easier is a cash kitty of $30 million put at Webb's disposal. "Once the word got out that we're looking, the deals started coming in," remarks Webb, gesturing at several tall stacks of proposals on his desk. The strategy he has defined contemplates "no wild things" but, rather, bringing in firms that fit EM&M's mix. Its major business is producing computers for adverse environments, primarily for the military, with machines that are compatible with Intel Corp.'s line of board computers. Also growing fast are sales of its permanent-magnet dc and brushless motors for computer peripherals and industrial controls. Moreover, magnetic core memories have shown signs of expanding after years of stagnation.

Webb doesn't rule out deals with high-technology companies with businesses in contiguous areas, such as telecommunications. Still well known from his TRW days, he serves on many corporate boards and sees opportunities in investing in high-tech start-ups.

Such a move is "low-risk if done right and could have a nice payoff." As Webb explains, the risk is low when compared with acquiring top-dollar firms. The trick is picking the right management with the right product.

One advantage an experienced management team like Webb's can offer a new firm is help in putting together an organization, something that most venture capitalists cannot offer. Marketing expertise for new companies is also in particularly short supply and Webb thinks his experience and the established competence at EM&M could be an attraction for fledglings.

One change is in the works, though—a name change for the company. "We're getting rid of the 'Magnetics' in our name. It's too limiting." –**Larry Waller**



Acquisitive. J. Sidney Webb will attempt to expand sales of Electronic Memories & Magnetics Inc. by buying companies.

George steering Motorola MOS Division down the road toward zero defects

Austin, Texas

Before any chip manufacturer can push defect levels much lower, it will have to accept totally new approaches to grading quality, says James K. George Jr., newly named director of reliability and quality assurance at Motorola Inc.'s Metal-Oxide Semiconductor Division here.

George, who left the firm in 1976 and returned last spring, believes that a heavy emphasis on statistical process controls and tighter quality checks for incoming materials will be needed if any company is to cross the 300-defective-parts-per-million mark. Once these improvements are in place, the final test at the end of a production line will be almost unnecessary, he says. Instead of testing devices from each lot, random sampling could be used after defect levels reach zero.

By year-end, the Austin MOS operation intends to lower outgoing defect rates from 300 to 100 parts per million. The 1985 target is 50 parts per million; by the end of 1986, it will be zero. Part of Motorola's corporate goal is to improve quality tenfold every five years, states George.

The 42-year-old native of Princeton, West Virginia, received his BSEE from Virginia Polytechnic and State University in 1964. He joined Motorola's Semiconductor Group in Phoenix and later earned an MSEE degree from the University of Arizona in Tempe.

After becoming involved in Motorola's complementary-MOS activities in the early 1970s, George joined Solid State Scientific Inc. of Montgomeryville, Pa. In 1981, he left to become director of memory and microprocessor operations at RCA.

Putting the problem in perspective, George emphasizes that varying needs call for varying solutions. "To get from 1,200 parts per million in 1982 to 300 today, you had to do certain things. But to get that number down from 300 to 50 or zero requires an entirely different set of things," he states.

He says that the need of the moment is the integration of statistical process control methodologies into many fabrication and assembly steps. Statistical control requires heavy scrutiny of processes and definition of acceptable limits. Each stage of production is then carefully monitored.

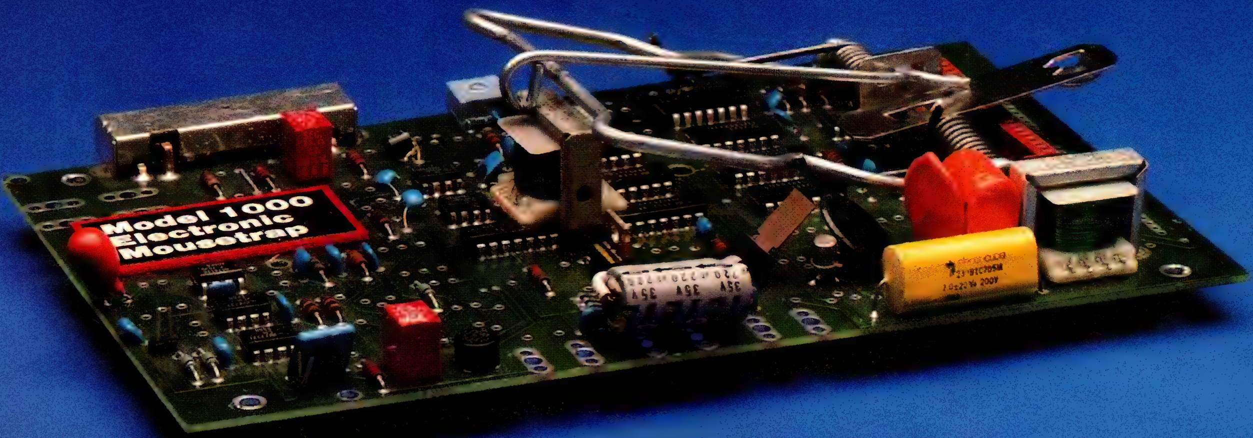
Stickler. Motorola's James K. George Jr. will have tighter process controls and quality checks for incoming materials in his effort to reach zero defects by 1986.

Over time, chip companies can phase down current test procedures. "If any of the controls fail, you have to go back to checking each lot," he says, adding that Motorola customers have voiced strong support for the aggressive program.

"We are about at the level where we have to start changing the procedure if levels are to drop further," he says. "You have to build in the quality from here on. No longer can you just test it into the product at the end of the line. Hence, our massive program to boost incoming inspection and add statistical process control, which are coming on stream in 1984 to allow continued improvements."–**J. Robert Lineback**

"If you make a better mousetrap, the world will make a beaten path to your door."

Ralph Waldo Emerson, 1855



"If you design a better mousetrap, the world won't necessarily make a beaten path to your door."

ElectronicsWeek, 1984

In the electronic Eighties industry needs better decisions, not just better designs.

Electronics, the world's most dynamic industry, is changing. And Electronics, the magazine that covers the industry, has been changing right along with it.

Ralph Waldo Emerson was wrong.

Better designs are no longer the only keys to success. In the electronic Eighties a company must make better decisions. And they can only be made consistently by industry professionals who are well informed.

Today, good technical and business decisions must be based on a broad understanding of where the industry is. And where it's going.

In other words, with the kind of insight that only a classic industry publication like Electronics provides.

More disasters to come?

The bankruptcy of Osborne, and RCA's $580-million videodisc write-off are just the tip of the iceberg. More possible disasters lie hidden in the future.

And they can only be prevented by decision makers who, regardless of discipline, possess the most complete, accurate and current industry information available.

This is the
last issue of
Electronics.

JULY 12, 1984

MICROCOMPUTER WORLD NERVOUSLY AWAITS IBM'S PC II/83

Fast 32-bit Futurebus anticipates new architectures/108

Active matrix addressing improves flat-panel displays/113

SIX DOLLARS A Mc GRAW-HILL PUBLICATION

Electronics®

Which is why Electronics is now ElectronicsWeek.

The electronics industry is growing up. And Electronics, the voice of the industry, is growing along with it.

We're not changing our name.

McGraw-Hill is just adding the word "Week" to our 54-year-old "Electronics" name. From now on readers of the magazine that gave the industry its name will be able to get more of the same information, more often.

Every important industry has a powerful, authoritative weekly magazine. In the aviation industry, it's Aviation Week. In the advertising industry, it's Advertising Age. And so it goes.

Paid, worldwide, and now weekly.

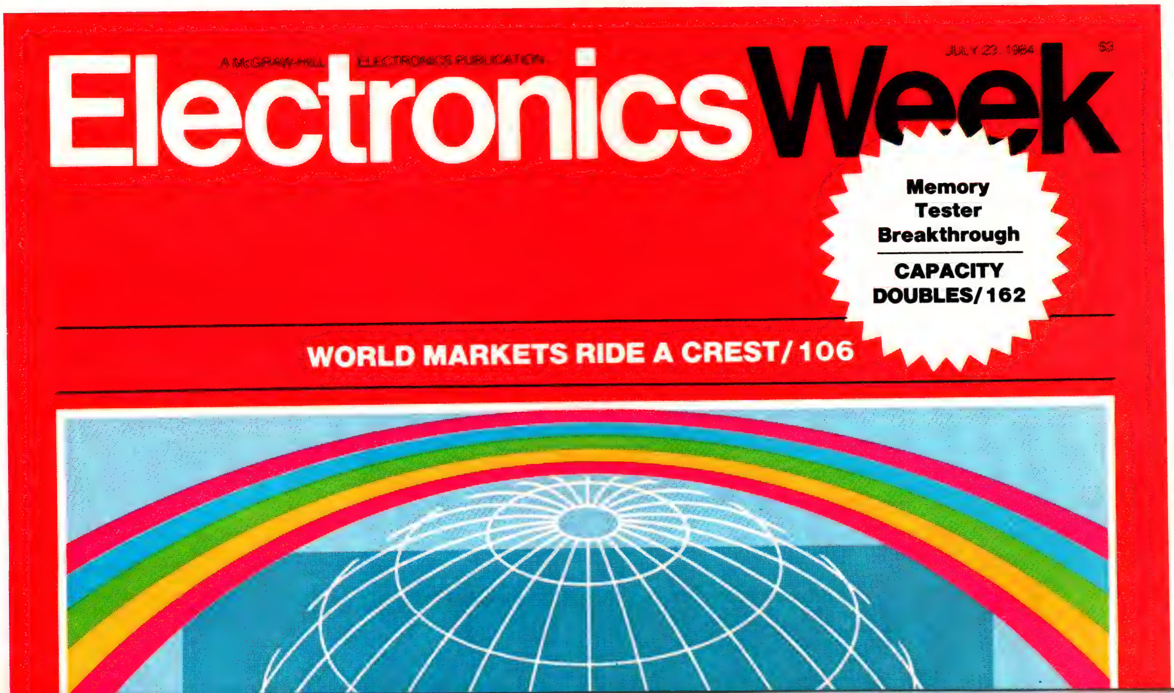
We're paid circulation. Which is one reason we can afford ten dedicated, full-time news bureaus around the world. It's also why we can have more editors than any other publication in the field.

Our exclusive worldwide circulation attests to an excellent international editorial product. One that is more respected and relied upon than any other publication in the electronics industry.

Starting July 23, ElectronicsWeek, the voice of the industry, will be heard each week.

Mc
Graw
Hill

This is the
first issue of
ElectronicsWeek.


A McGRAW-HILL ELECTRONICS PUBLICATION
JULY 23, 1984
$3
ElectronicsWeek
Memory Tester Breakthrough
CAPACITY DOUBLES/162
WORLD MARKETS RIDE A CREST/106

Telecommunications Engineers

The Engineering Muscle And The Technical Talent To Lead A Telecommunications Revolution... Right Here With Hayes In Atlanta.

We've built a powerful engineering and technical team here at Hayes. It's been our strength and the reason for our success from the very beginning. Our focus has been on recruiting and developing the talent it takes to do more than merely compete, but to lead. The result has been a success story few in the industry can equal.

For those of you who have searched far and wide for just such an environment, where talent is provided the freedom and encouragement to grow, then perhaps it's time to take a good, hard look at Hayes in Atlanta. There's a future in it.

- HARDWARE/MICROPROCESSOR DESIGN ENGINEERS
- SOFTWARE DEVELOPMENT PROGRAMMERS/ANALYSTS
- VLSI/DSP DEVELOPMENT ENGINEERS
- PRODUCT ENGINEERS

Interested, qualified candidates should forward a confidential resume to: **Hayes Microcomputer Products, Inc., Dept. TJC-84, 5923 Peachtree Industrial Blvd., Norcross, GA 30092.** An Equal Opportunity Employer, M/F.

Opportunity for the here and now.

Hayes®

Hayes Microcomputer Products, Inc.

PLESSCOR, WITH TOP BACKING, RUSHES TO FIBER-OPTICS MART

Los Angeles

For all the sage agreement that fiber optics will play the workhorse role in transmitting gigabit data streams in telecommunications equipment later this decade, the necessary components generally are in short supply. The void is most glaring in the U.S., industry sources say, which is not doing any significant manufacturing of the emitters, detectors, and integrated circuits that operate in the longer wavelengths where the technology performs most efficiently: 1,300 to 1,550 nm.

The potential is unquestioned, and already at hand. The trick for interested companies is to get moving quickly, with immediate products, before competing U.S. semiconductor firms can tool up to exploit it or the Japanese telecommunications behemoths gain a strong foothold.

A promising shortcut to this objective sure to attract attention is being demonstrated by a new firm, PlessCor Optronics Inc., which began operations here in May. It has money, technology, and—most important for the short run—the existing fiber-optic expertise of its two heavyweight partners: U.S. fiber-supplier Corning Glass Works, Corning, N.Y., and the British industrial giant Plessey Co. plc, Ilford, Essex, which has been turning out fiber components for European markets since the mid-1970s.

Already delivered. PlessCor, in fact, already has made deliveries in the U.S. of Plessey parts reconformed here for the custom configurations that the communications industry demands. "In that sense, we're an existing company, not a new start," says Michael K. Barnoski, the firm's founder, president, and chief executive officer.

His company is partially owned by Plessey and Corning, but he declines to say how much the two powerhouses have invested in PlessCor, nor how much of the firm they own. Plans are to produce the Plessey components at a facility here and start turning them out early next year.

Starting a business in this manner shaves years off the time that it takes to follow the conventional venture capital route, Barnoski says. And there are further benefits as well: "It's not just money but having partners who are investors, who have strategic interests in the business. We can set up fast by not doing R&D or product development."

Plessey has one of the most comprehensive fiber-optic product lines in the world and is developing very large-scale integrated optical circuits. Corning's U.S. customer base also gives PlessCor an established marketing target. "We can access all that," says Barnoski.

PlessCor technical teams from the U.S. have spent months at Plessey's U.K. facilities, learning its techniques in product design, manufacturing, and assembling. This know-how is going into building semiconductor production equipment for the U.S. plant. The equipment will be assembled in the U.K. and shipped to the U.S. in late 1984.

Barnoski until last year directed optical research at TRW Inc., and before that for Hughes Aircraft Co.'s Malibu Research Laboratories. Joining him at PlessCor are other noted optical researchers from TRW—Bor U. Chen and H. David Law—and two executives from Corning's Telecommunications Products division: Stephen D. Brewer, PlessCor's top financial officer, and Michael J. Hartmann, a marketing specialist. Theodore H. Maiman, developer of the first laser, is a consultant and board member.

Though the new firm will stick initially to the Plessey line, it plans to keep a close eye on the two major technical issues affecting fiber optics. Barnoski defines these issues as the shift from multimode fiber to single-mode and the impact that will be made by the laser-scanned audio disk on fiber optics.

Teamwork. Joining with two established firms gives PlessCor an advantage in making inroads into the fiber-optic market, thinks president Michael K. Barnoski.

Quick acceptance. Because single-mode fiber produces more information capacity than multimode and has lower material costs, the speed of acceptance in the marketplace has surprised even researchers, he notes. It is not yet clear how the laser-scanned disk will employ fiber, but its looming popularity as a consumer product—because of superb audio performance—makes it an issue worth tracking, says Barnoski.

The market for active and passive

fiber-optic components will likely expand past the $1 billion level within five years, which should guarantee well-financed competition. Barnoski sees AT&T Technologies making a top effort, along with Motorola Inc. and RCA Corp., among U.S. firms.

NEC Corp. and Fujitsu Ltd. already have demonstrated their leadership in Japan and can be expected to expand into U.S. markets. Prospects for this brand of competition, Barnoski notes, make it all the more imperative that PlessCor establish itself quickly. **–Larry Waller**

LaPine set to produce 3½-in. Winchesters

Santa Clara, Calif.

Just six months after assembling its research and development team under one roof, LaPine Technology Corp. unveiled a prototype of its rugged 3½-in. Winchester disk drive at last month's National Computer Conference. Anthony LaPine, chairman and president, virtually glows with optimism when he talks about the way his firm is rolling along—and its plans to begin production in the fourth quarter.

He is equally pleased with how the market is shaping up [*Electronics,* May 31, 1984, p. 45]. "The demand for 3½-in. products will be awesome next year," he declares in his usual low-key style.

Meeting demand. The company's Santa Clara plant, scheduled for completion in the fourth quarter, will be able to produce as many as 100,000 3½-in. drives next year, LaPine says.

The firm is seeking a second round of funding to boost the planned rate of production, but LaPine says it may wait until the equity market rebounds. "We might be faced with giving up a larger percentage of the company than we want to in order to ramp production high." Despite the outcome, he fully expects his young firm to make at least 27,000 units in 1985.

For his firm—and other potential startups—to be successful in the 3½-in. Winchester drive business, LaPine believes it's imperative for companies such as Seagate Technology and Tandon Corp. to enter the market. "Without them, the small firms don't have a chance. Companies like IBM won't buy solely from a startup. They might buy some, but not exclusively until the startup proves itself," the executive states.

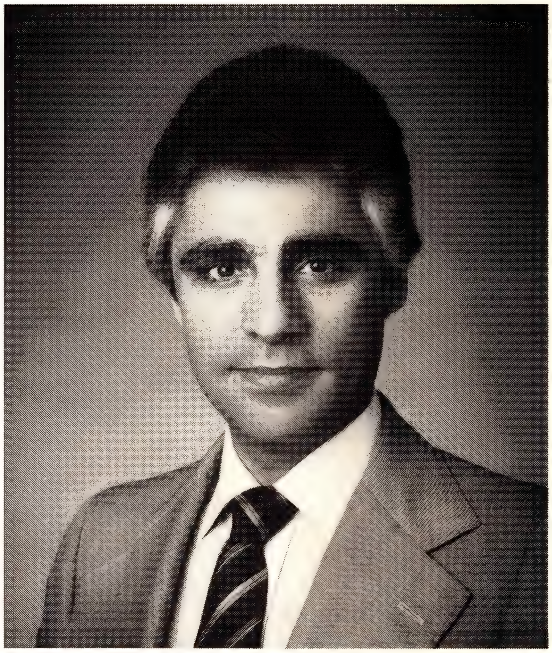
During next year, LaPine hopes to introduce 20- and 30-megabyte 3½-in. Winchester drives, and by 1986, a 10-megabyte drive that stands 0.8-in. high. Also during 1985, he hopes to arrange offshore manufacturing to augment the Santa Clara line, but says the company will not do so without a partner in the chosen country. "It's incredibly hard to manage from 8,000 miles away. You don't know the culture or the infrastructure," he says.

LaPine's Winchester drives incorporate a patented shock-resistent design, in which heads can be moved away from the disk when the equipment is being moved. Financing is being provided by the company's funding arm, LTC Partners Ltd., an R&D partnership with 61 limited partners who invested $50,000 each.

To manufacture the drives, LaPine Technology has developed a sanitary module encapsulating the production line. "The tunnel requires a relatively small area of Class 100 clean room," says LaPine. Employees work with only their gloved hands inside the module. This allows workers to stay in their street clothes, and provides a cleaner production environment, resulting in fewer faulty parts, he says.

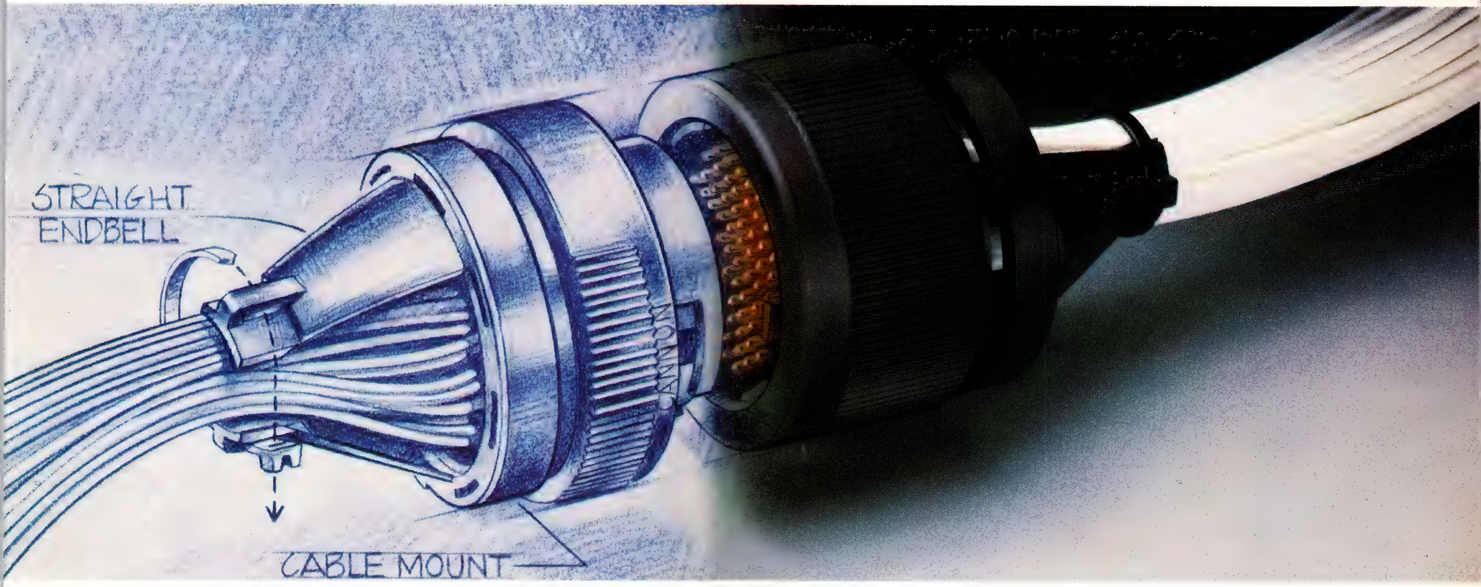
To guide the company, he has rounded up a board of directors that includes Gene Amdahl, founder of Amdahl Corp., and Albert Handschumacher, former president of Lear Siegler Inc. The staff includes Herbert Ragle, vice president of engineering; Edward Doan, vice president of manufacturing; and Thomas Giluso, chief financial officer. Ragle used to be director of engineering for Shugart Associates' Optimem Division; Doan, vice president of manufacturing technology at Disctron; and Giluso, chief financial officer of Cushman Electronics.

Seasoned exec. Before founding the firm, LaPine was chief operating officer of Irwin International, the Ann Arbor, Mich., manufacturer of 5¼-in. Winchester drives. Prior to that, from 1969 to 1980, he was vice president and general manager of Memorex Corp.'s Disk Drive Division. **–Stephen T. Haggerty**



Glowing. With computers systems shrinking in size yet growing in power, the demand for 3½-in. Winchester disk drives will increase tremendously next year, thinks LaPine Technologies' president Anthony LaPine (right), who is optimistic about his startup firm's chances in this arena with its new product (left).

Our best customers have problems with us.



Bring us your toughest connector problems. And our engineers will work with you to develop the most effective connector possible.

Some of today's most widely used connectors originated from our engineers' innovative problem-solving abilities. The XLR, which has become the new world standard for commercial-grade audio connectors. The universally accepted D Subminiature series of metal-shell rectangular connectors. And the DL/RDL zero-insertion-force circular and rectangular connectors. These are just a few of the many connectors that began as new product developments at ITT Cannon.

And tomorrow we will include the world's most complex and critical zero-insertion-force pin grid connector on our list. It's currently under development at Cannon — to meet one customer's unique requirements.

When your requirements go beyond the catalog, our engineers will work with you from conception to connection. And together we'll turn your problems into connectors.

People and ideas. Together, they create solutions.

So call Cannon. You'll get more than great connectors. You'll benefit from our expanded R&D program — **Response and Delivery.**

ITT Cannon Belgium, Brussels —
Phone: 02/735.60.94
Telex: 846-23249
ITT Cannon Great Britain, Basingstoke, Hants —
Phone: Basingstoke (0256) 3171
Cable: Cannelec
Telex: 851-858-105
ITT Cannon France S.A. Bagneux —
Phone: Paris 664-1622
Cable: Canelcosa
Telex: 842-270234
ITT Cannon Italiana SpA, Milano —
Phone: 83.58.351
Cable: Cannonital-Milan
Telex: 843-32361
ITT Cannon GmbH, West Germany, Weinstadt —
Phone: 07151/604-0
Cable: Cannongmbh
Telex: 724-343-0 Ca-d

CANNON ITT
The Global Connection

Circle 64 on reader service card

LEADER

0.8~1GHz Standard Signal Generator with 100-Point Memory

For Communication Receiver, Car Telephone & Cordless Telephone

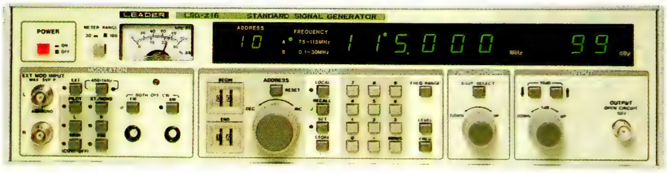
NEW LSG-203 FM STANDARD SIGNAL GENERATOR

Frequency, output level and modulation can be set digitally by ten-key input up to 100 points. This model can combine these three items into one set of data.

●FREQUENCY RANGE: 800~999.9999MHz ●RESOLUTION: 100Hz ●ACCURACY: 1ppm ●RF OUTPUT: −10~110dBμ(0 dB=1μV, open circuit), −123~−3dBm (0 dB=1mW) ●MODULATION (FM): internal 300 Hz, 1kHz, 3kHz and external

For FM/AM Radio, Communication Receiver, Cordless Telephone & Television IF

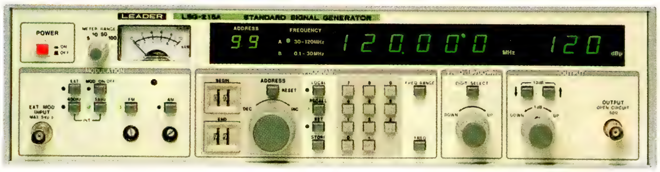
LSG-215A FM/AM STANDARD SIGNAL GENERATOR



●FREQUENCY RANGE: 0.1~30MHz, 30~120MHz, two ranges ●RESOLUTION: 100Hz(0.1~30MHz), 1kHz(30~120MHz) ●RF OUTPUT: −10~120dBμ(0 dB=1μV, open circuit) ●MODULATION(AM/FM): Internal 400Hz, 1kHz and external

For FM Stereo Receiver & FM/AM Radio Receiver

LSG-216 FM/AM STANDARD SIGNAL GENERATOR



●FREQUENCY RANGE: 0.1~30MHz, 75~115MHz two ranges ●RF OUTPUT: 99dBμ, 50Ω(0 dB=1μV, open circuit) ●MODULATION(AM/FM): Internal 400Hz, 1kHz, and external ●FM STEREO MODULATOR: L,R,MAIN and SUB signals ●SEPARATION: More than 40 dB(1kHz)

LEADER ELECTRONICS CORP.
2-6-33 Tsunashima-Higashi, Kohoku-ku,
Yokohama 223, Japan
PHONE:045-541-2121 TELEX:J47780 JPLEADER

SUBSIDIARIES

LEADER INSTRUMENTS CORP. (U.S.A)	PHONE:516-231-6900
LEADER INSTRUMENTS(H.K.)LTD.	PHONE:3-7212503

Circle 66 on reader service card

ElectronicsWeek

SPECIAL REPORTS

LOCAL NETS ARRIVE IN FORCE

A market melting pot seeks the cohesive effect of standards for local networks as technological advances multiply

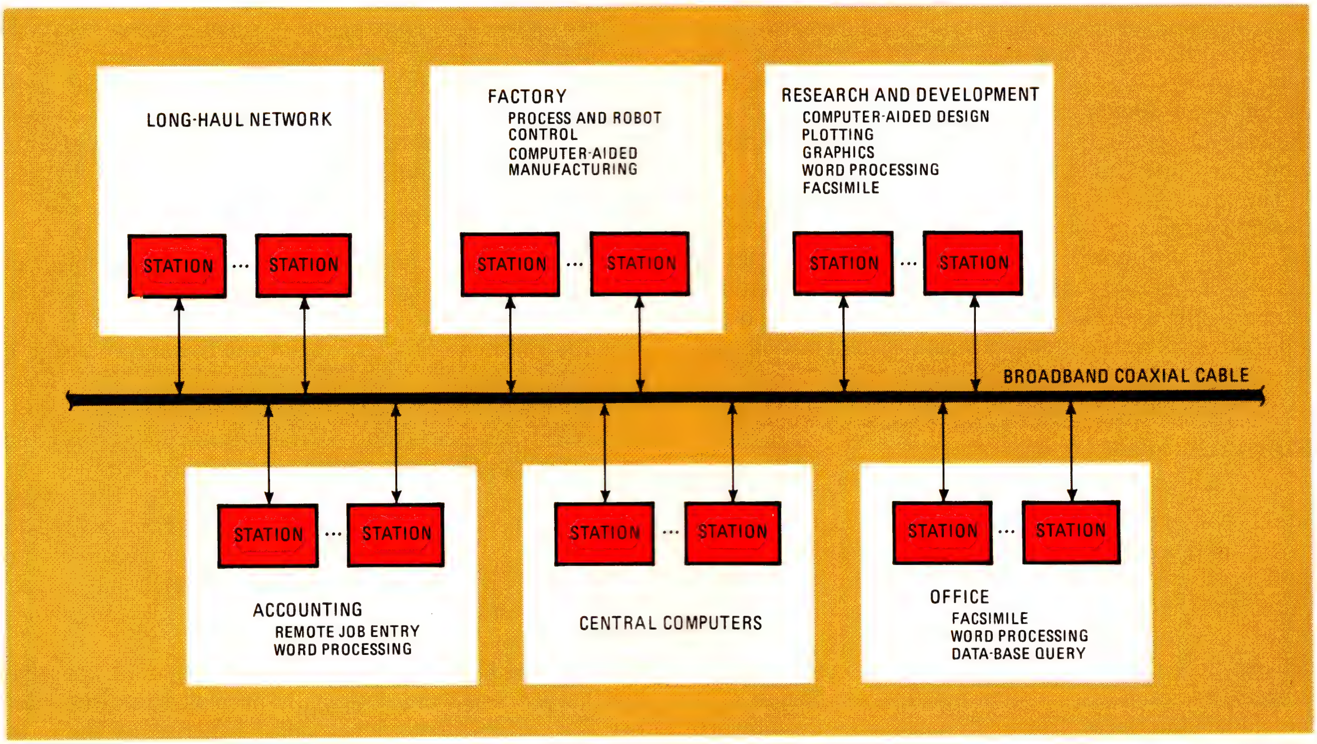
☐ *by Robert Rosenberg and Terry E. Feldt*

Fully digital local data-communication systems are no longer on the horizon. They're here. And with them comes vigorous competition for users' dollars, along with more confusion for buyers.

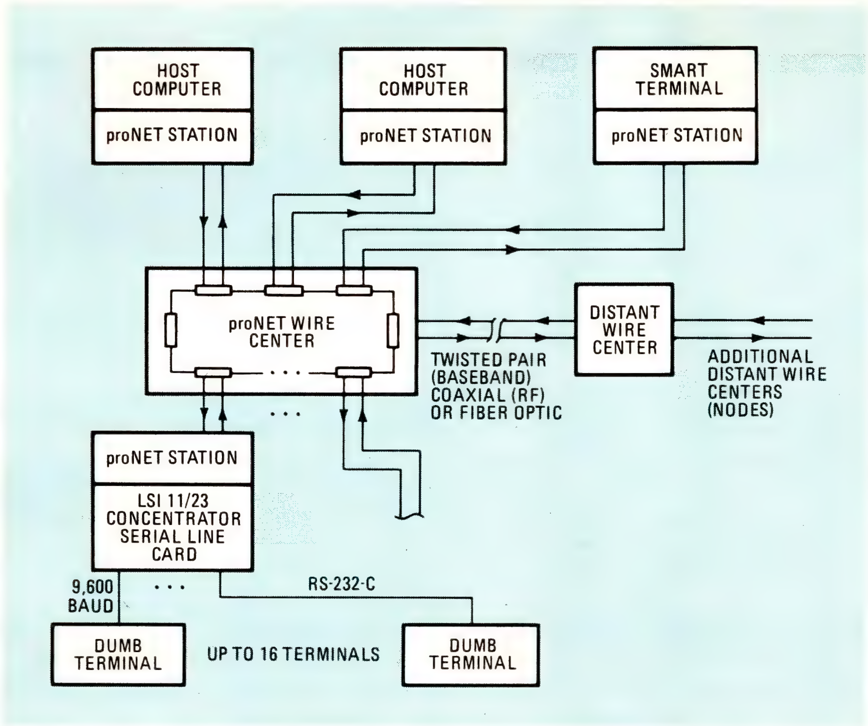
Players in all facets of the electronics industry are moving in. The big chip-makers are intent on getting a jump on the market for large-scale integrated circuits that can handle the functions of local networks—called LANs, for local area networks—while large system-suppliers see their prospects hooked as much to buildings' existing and future wiring as to the black boxes that local networks require.

But riding the crest of the local communications wave are the local nets themselves. Originally, a central computing facility used shared applications and memory. In the mid-1970s, as data processing applications proliferated, the central computer frequently became overburdened and users became disgruntled about slow response times. But even as bottlenecks developed at the central site, the costs of processors and memories were being driven down by large-scale integration, so the trend turned to moving applications and memory away from the central computing facility to remote sites with processors running distributed applications.

Still, users wanted all of the familiar advantages of a central site—shared data, cheap memory, and the easy communications paths found in a timesharing environment. Thus were born local networks, mechanisms that



1. Token bus. With an 802.4 protocol, Concord Data Systems' local network can link end-user equipment with diverse requirements for throughput and bus access response times. The token interface modules, or stations, provide data exchange rates up to 230 kb/s.



2. Token ring. Proteon's star-shaped token ring net is built around a passive wire center that isolates network operation from station failures. Several types of cable, all carrying 10-Mb/s signals, can be used to interconnect wire centers to form a string of stars.

enable data to be transferred between independent devices that are confined within a geographical area—office buildings, factories, or even a city and its suburbs. Local networks run typically in the range above 1 Mb/s.

The key to this exploding market is flexibility: the ability to support diverse types of equipment with varying transmission requirements. At the global level, work aimed at open-systems interconnection (OSI) presumably will allow the interfacing of practically any processor to any other one, anywhere. This effort finds its impetus not only in the support of mammoth data processing centers—traditionally found in universities, insurance companies and the like—but also in the explosive rise in the use of small computers and terminals, which today are showing up in almost every business and in a growing number of households.

The goal of universal interfacing, which the International Organization for Standardization (ISO) is pursuing, is still little more than an idea. However, the ISO has had its most striking successes in the specification of standards for the OSI lower rungs, the physical and data-link layers on the seven-rung local-net ladder. And these standards have come not a moment too soon for both the local-net industry and users.

Growth forecast

Since the appearance of the first local networks in the late 1970s, they have played an increasingly important role in making distributed processing possible, and their marketplace is not expected to diminish. According to Carol Snell, associate director of telecommunications industry services at Dataquest Inc., San Jose, Calif., local net expenditures for 1983-84 were $224 million and are expected to reach $1.31 billion by 1988, as the cost of the individual interface drops. Kenneth G. Bosomworth, president of International Resources Development, Norwalk, Conn., predicts growth at a somewhat slower pace.

"Cabling and network interface costs this year will run at about $230 million, but in three to four years the cost per interface will drop by a factor of three, from $1,200 to between $300 to $400, while the annual revenues from the sales of networking products will double," he forecasts.

The most significant influence on this drop in cost will be the standardization of local network products: the cables and interface boxes. While dozens of manufacturers rushed to the market with proprietary local nets that used such technologies as collision-sensing multiple-access with collision detection (CSMA/CD) and token passing on a bus, working groups sponsored by the Institute of Electrical and Electronics Engineers have hammered out what is becoming a series of local net standards—documents that define compatible interfaces regardless of equipment manufacturers. As new players now enter the local net arena—and as some established manufacturers look for ways to modify their devices for compatibility with the IEEE—potential purchasers are feeling much more inclined to make the leap into local networking, confident that they will not be locked into a single vendor.

Last month's demonstration of open-systems interconnection at the National Computer Conference in Las Vegas was dramatic proof of the importance that standardization will have in the marketplace. It showed that equipment from different vendors can be made to operate in unison using standard protocols.

Two demonstrations

In one demonstration, organized under the auspices of Boeing Computer Services Co., a division of the Seattle, Wash., aircraft maker, multivendor products were tied together on an IEEE 802.3 CSMA/CD network using a high-level transport standard approved by the ISO [*ElectronicsWeek*, July 23, 1984, p. 45]. In another demonstration, General Motors Corp., New York, showed how the same transport protocols were used to link heterogenous processors from several manufacturers on an IEEE 802.4 token-passing bus network. The demonstration proved to manufacturers that standards at the lower levels of the OSI model are well enough along to encourage their making investments in bringing products into compliance with the standards.

At this point, the 802.3 CSMA/CD standard is probably the furthest along. Originally propelled into the market as a proprietary product called Ethernet by the powerful alliance of Xerox Corp., Stamford, Conn.; Digital Equipment Corp., Maynard, Mass.; and Intel Corp., San-

Europe casts its own local nets

In an attempt by the European Community to bolster and publicize its cooperative zeal and technological prowess, a showcase local network is being commissioned at the EC's Brussels headquarters over the next two years. Called ELAN, for European Local Area Network, it will be used by the EC's Task Force for Information Technology and Telecommunications to link work stations and provide office automation and data processing facilities. The contract has been awarded jointly to ICL plc, Ing. C. Olivetti & C., Bull, and Siemens AG. ELAN will serve as a showcase for European manufacturers showing different internetworking kits and will be a demonstration of the community's agreement to promote open-systems interconnection standards [*Electronics*, March 22, 1984, p. 63].

The system will be based on ICL's standard, Oslan (for Open Systems Local Area Network), a 10-Mb/s CSMA/CD local net, conforming to the IEEE 802 local net standard. In addition to Oslan, ICL has under development a less expensive net called Cheapnet. The basic difference between the two is in their use of coaxial cables of different diameters. Instead of the 0.4-in.-diameter cable used in Oslan, Cheapnet uses a smaller and more flexible 0.25-in. cable. However, its capacitance is larger and thus segment lengths must be shorter.

In other respects, the electrical performance of the two systems is very similar; both networks have a characteristic impedance of 50 Ω. Oslan segments can be up to 1,600 ft in length and can support up to 100 nodes, while Cheapnet segments are up to 600 ft in length and can support up to 30 nodes. Both network topologies will support a maximum of 1,024 nodes. Cheapnet is not yet an ICL product; a specification will be completed by the third quarter of 1984 and will be adopted as a cost-effective alternative to the IEEE 802.3 local net specification. **–Kevin Smith**

ta Clara, Calif., it has evolved into an accepted standard. According to Don C. Loughry, chairman of IEEE's 802.3 committee, the second revision of the Xerox-Intel-DEC Ethernet specification published in November 1982 is "substantially compatible" with the 802.3 standard approved by the IEEE a year ago and sent along to the the ISO for consideration as an international standard. To bring the Ethernet document in line with the IEEE standard required adding a grounding specification for safety, tightening up the signaling requirements, dc-coupling the transceiver and interface controller, and adding jabber control to increase reliability.

In large measure, the success of Ethernet-based networks in the market is a consequence of the investment that Xerox has made in the higher-level protocols. Besides defining the physical and data-link-layer requirements in Ethernet, Xerox continued up the seven-layer ladder with its Xerox Network Systems, providing network designers with the protocols they need to build applications. According to Jerry Elkind, vice president for systems integration at Xerox Systems Group, in Palo Alto, Calif., XNS "follows the general style of the open-systems interconnection" scheme, and is going to conform to OSI standards when those standards are approved; however, the higher-level XNS protocols have already become a de facto standard.

"Two years ago we fell into the lunatic fringe," trying to sell networking products to large end-users with multivendor installations, says Judy L. Estrin, vice president of engineering at Bridge Communications Inc., Mountain View, Calif., one of many firms using the XNS higher-level protocols. "But now we have mainstream Fortune 500 companies" lined up for the firm's packet-switched-based implementation of Ethernet.

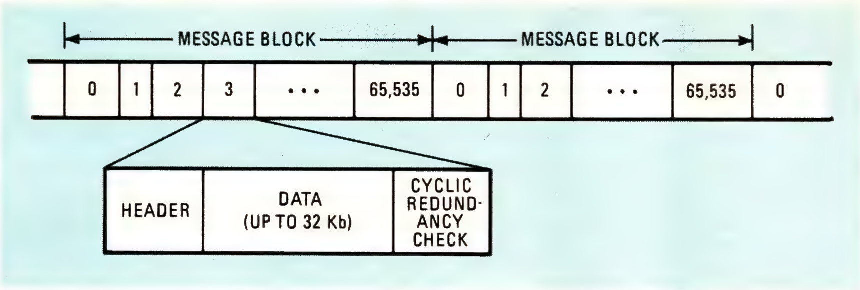
There are at least seven firms pumping out Ethernet controllers, and although the overall costs of implementation on a per-node basis have dropped, the long-standing complaint has been that the high costs of cable and connectors have had a dampening effect on the proliferation of personal computers. This may soon change, since the IEEE is considering adding a specification for a less expensive version of the medium, using RG58AU cable and BNC connectors, dubbed Cheapernet. National Semiconductor Corp., Santa Clara, Calif., is already in production with a chip set that supports Cheapernet, betting that the low-cost cable-and-connection system is going to be part of the 802.3 standard in Europe. The burgeoning local-net field, in fact, is sparking efforts on both the Continent and in the UK (see "Europe casts its own local nets").

Standardization work has also progressed in the direction of another local net, the 802.4. This standard specifies token passing for the access to a bus. The station that currently has possession of the token is permitted to transmit for a maximum fixed period determined by the size of the network. At the conclusion of the transmission, the station surrenders the bus by sending the token on to the node with the next logical address. Thus, token passing assures that all stations will have a transmission opportunity within a set delay.

Synchronous control

Token passing is of much interest to those concerned with data transfer between synchronous devices, such as for process control in factories. IBM Corp., Armonk, N.Y., has endorsed 802.4 as "one suitable approach for a general plant-floor local network" using broadband coaxial cable, and the firms now developing 802.4 nets are indeed looking to industrial applications as a bread and butter market for their products.

Token buses "will be *the* dominant factor in the factory," predicts Ralph K. Ungermann, president of Ungermann-Bass, Inc. Thus the Santa Clara, Calif., firm will be adding an 802.4-compatible product to its current line of broadband, baseband, and fiber-optic local networks that now support Ethernet protocols. Ungermann expects the 802.4 net to be released in the first half of 1985, and indicates a token-ring net is also in the works. For compatibility among the various network types, "we offer bridges between these technologies," he says. According to Dan Gahlon, industrial marketing manager for 3M Interactive Systems, St. Paul, Minn., 802.4 may



3. All together now. A station can transmit variable messages—up to 32 kb—on Uni-LAN, either in contention with other interface units or at dedicated message numbers. One station, the pacer, informs late-entering units of the current network configuration. The pacer transmits at message numbers 0, 1,024, 2,048, etc., in each block.

migrate to the office environment from its industrial beachhead because the entire local net market is still "embryonic." But 3M first will be aiming at the factory floor with its 802.4 net, which is due for production in mid-1985.

3M intends to supply a gateway for compatibility between its existing 2.5-Mb/s token-passing broadband LAN/1 products and the newer 802.4 system. To optimize the access time and maximize the network throughput, however, 3M has opted for the 10-Mb/s version of 802.4. On the other hand, Concord Data Systems Inc. charted its course for the 5-Mb/s version, and the Waltham, Mass., firm is now the frontrunner in supplying an 802.4 product.

Fully integrated

Concord's director of product marketing, Tony Bolton, expects that the Token/Net will be shipped by November of this year, when hardware and software have been fully integrated. The plan for the final equipment configuration is to download station software from a network control computer, probably an IBM PC XT personal computer. Currently, firmware is resident in each station. Concord sees the market niche for its system not just in the factory environment, but in linking any of the synchronous and asynchronous devices showing up in today's business settings (Fig. 1).

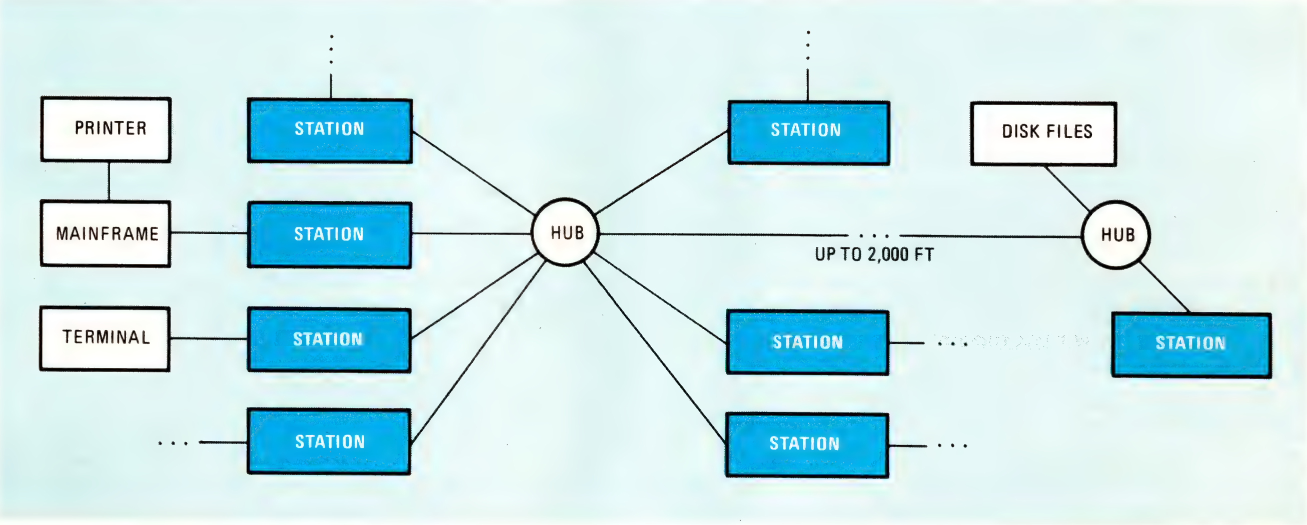
Unlike the CSMA/CD and token-bus-based networks, where implementations have outstripped the setting of standards, development of a token passing on a ring has lagged while the world waits for IBM. At the end of July, at their annual meeting, the IEEE 802 committee approved a draft of the of a token-ring standard. The draft was somewhat controversal because in the 802.5, the bit order during transmission begins with most significant bit first, whereas other 802 standards specify the least significant bit first. Editorial changes are being made to the document, and a revised version should be ready to present to the IEEE standards board by September.

When IBM unveiled its token-ring prototype using twisted wire pairs and baseband coaxial cable running at 4 Mb/s, at the Telecom/83 Fourth World Telecommunication Exhibition in Geneva in late 1983, analysts predicted that a full-blown network would be announced early this year. So far, however, it has not materialized.

One of the few firms fielding a token-ring net—albeit one that does not conform to an IEEE standard—is Proteon Inc., of Natick, Mass., with its 10-Mb/s proNET. ProNET is star-shaped, with its nodes built around a passive local ring (Fig. 2). An energized relay links a node to the center. Just as in a household circuit breaker, if a node goes down, the relay turns off, isolating that node but not affecting the others.

Two-way paths

A full-duplex path connecting the nodes to the center can be created with various media, including twisted-wire pairs, twin-axial and coaxial cable, and fiber-optic cable. The latter technology is slowly gaining in popularity. In particular, fiber is useful for applications requiring high immunity to electromagnetic interference and lightning-



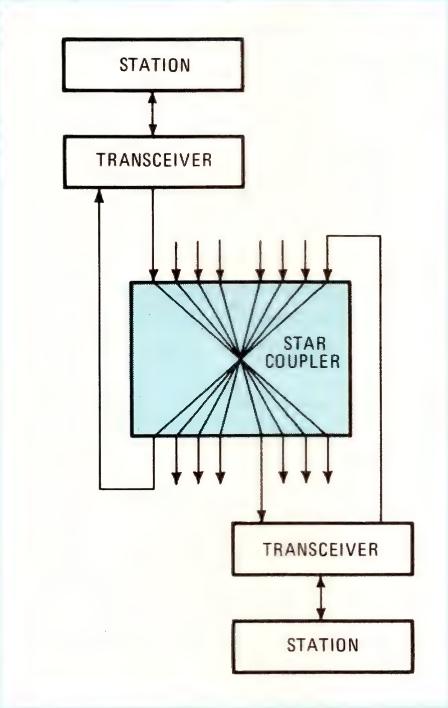
4. Free-forming tree. Datapoint's ARC network topology is free-forming so long as no loops are formed, no station is farther than 31-μs (about four miles) from any other station, and cabling between hubs does not exceed 2,000 feet.

When a bus is a star

The most common method of wiring within the center of a star-shaped fiber-optic local network involves joining the fibers in a star coupler to emulate a bus topology. The flux attenuation from any transmitter to any other receiver in such a local net then remains nearly the same regardless of which transmitter is active. Conversely, for a linear bus arrangement implemented with fiber, sequentially coupling the transceivers to the bus would result in wide-ranging insertion losses among the combinations of transmitters and receivers, and thus would limit the total number of stations supported by the network because of the dynamic range of the optical receivers.

An optical star coupler is supplied by Codenoll Technology Corp. for its 10-Mb/s Ethernet-type network. The Codestar coupler is fabricated by heating, stretching, twisting, and fusing a group of fibers. One side of the device is arbitrarily chosen as the input: the fiber ends to which optical pulses will be applied. Light flux is divided equally among the fiber ends on the output side of the device. The Yonkers, N.Y., firm claims that up to 2,500 m of fiber can be strung between any two stations connected through a 16-port Codestar, and that the detection of optical collisions is more accurate over long distances, compared to a conventional coaxial-based Ethernet local network.

With the fiber-optic implementation of Net/One—a 10-Mb/s Ethernet-compatible product line by Ungermann-Bass, Inc., Santa Clara, Calif.—station separation can be extended to 2,800 m by using an eight-port star coupler (see figure). This range includes 50 m of standard Ethernet transceiver cable running between each station, or network interface unit, and its corresponding transceiver, which makes the connection to the two-fiber optical cable. Anthony P. Russo, director of product marketing, notes that "probably two out of three" of the fiber-optic Net/One sales are for use as a backbone to link coaxial-based Ethernet local nets through local repeaters.



induced surges. The small size of the fibers also makes them attractive when duct size is at a premium. Bus configurations are predominant in fiber-optic nets, although sometimes these buses take the physical shape of a star topology (see "When a bus is a star").

At the end of the IEEE's list of local networking standards is 802.6, which someday may be a specification for a network that can link devices throughout an entire city. The 802.6 charter considers a metropolitan area to be an area with a radius in the tens of kilometers. "The ideal vehicle for the metropolitan network is the coax plant of CATV [community-access television]," says 802.6 Working Group chairman James S. Mollenauer, a senior consulting engineer with Codex Corp., Mansfield, Mass. However, Mollenauer indicates that other media, possibly microwave links, eventually may find applications in the metropolitan connection.

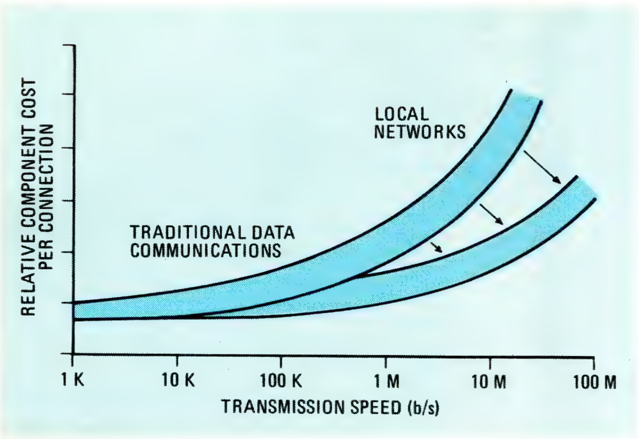
CATV proposals

Although work began on 802.6 early in 1982, no specification has been drafted; the working group has been wrestling with various proposals for network schemes. One proposal being entertained comes out of the Ann Arbor, Mich., facility of 3M Interactive Systems. The scheme relies on standard CATV video channels as the medium for data transmission at 3 Mb/s. A centralized controller polls stations in turn and retransmits each response to the rest of the network. The time of an interrogation is a function of the physical placement of the polled station—the controller has *a priori* knowledge of these locations. Because of the long propagation delays—up to 0.5 ms—encountered in city-wide networking, the centralized controller can time interrogations to minimize dead time on the channel.

Another possible metropolitan network scheme—dubbed Homenet by AT&T Bell Laboratories—has been discussed by the 802.6 working group, and AT&T has "an implementation in the laboratory," according to Arun N. Netravali, director of the Computer Technology Research Laboratory at Murray Hill, N.J. The system employs what Netravali describes as a novel CSMA/CD-type protocol that does not exhibit the usual efficiency loss and packet-delay fluctuations caused by collisions. Thus, the scheme is capable of handling both packetized data and voice on unused CATV channels.

Over the last few years, much effort has been directed toward the development of the 802 series of standards. As will always be the case, however, some manufacturers are forgoing existing standards. For example, Applitek Corp. has come up with a distributed-access method, an approach that the Wakefield, Mass., newcomer believes has the advantages of both CSMA/CD and token passing.

The scheme subdivides system capacity into successive message blocks (Fig. 3). Within each block, 65,536 messages—numbered 0 through 65,535—can be transmitted. Message duration is as short as the two-way propagation time of the installed cable, and as long as is required for a 32-kb packet. If each message number is assigned to only one interface unit on the network, then



5. VLSI impact. As greater functionality is put into silicon, network transmission speeds can be increased while per node connnection cost drops. With standardization on the horizon for local network communications, more functions will migrate to silicon in the future.

the network operation resembles token passing: each interface unit is assured of periodic transmission opportunities. Another option allows for any interface unit to transmit at any message number, provided no collision is detected. This configuration is essentially CSMA/CD.

The Applitek system also permits mixing the dedicated and contention message-number assignments on a dynamic basis in concert with current network loading, with the result that more devices may be added to the 10-Mb/s network before unacceptable transmission delays occur. Using this performance benchmark, Applitek claims that its UniLAN system can support over twice as many devices as comparable CSMA/CD and token-passing nets can support. "That is the benefit of a network that adapts," says Ashraf M. Dahod, Applitek chairman and the developer of UniLAN.

Periodically, a UniLAN network interface unit designated the pacer—usually the first one to power up—transmits a block-synchronization message. This facilitates the system pacing, assuring that the 16-bit message-number counters in all units have the same concurrent value. The pacer also handles requests to allocate dedicated message numbers to particular interface units; these requests are initiated by the units themselves as transmission needs dictate. Message numbers usually are contention assignments until the pacer assigns them.

Of the nonstandard token nets, the tree topology used in Datapoint Corp.'s baseband coaxial ARC network (Fig. 4) is the oldest, and, with more than 5,000 installations worldwide, one of the largest. The network began as a proprietary product in 1977 and it was not until 1982 that the San Antonio, Texas, firm decided to drop licensing requirements and give their chip supplier, Standard Microsystems Corp., in Hauppauge, N.Y., the green light to market their token-passing 2.5-Mb/s COM9026 controller chip. In June, Datapoint made a major strategy shift and announced it is going all the way with open systems and will incorporate nonproprietary operating systems such as PC-DOS, MS-DOS, and AT&T Bell Laboratories' Unix and will become compatible with IBM's System Network Architecture.

According to Alan Malinger, director of strategy and planning at Datapoint, the company may have missed an opportunity to influence the deliberations of IEEE's 802.4 token-bus committee because management's attention was diverted elsewhere—the company was embroiled in a serious controversy over its accounting procedures. Recent standardization decisions on 802.4, he said, "have caused some grief."

"We're an 8-bit addressing scheme," he continues. 802.4 is using a 48-bit addressing scheme at 1-, 5-, and 10-Mb/s data rates and "we don't want to pay the overhead to address everybody at very high speeds."

Because the Datapoint controller technology has been around for so long it is reliable, and for that reason more than a dozen network manufacturers such as Nestar Systems Inc., Palo Alto, Calif., use it in their networks. But Western Digital Corp., Irvine, Calif., which came along more recently with their WD2840, a 1.1-Mb/s token-passing controller with on-board direct memory access, is claiming greater flexibility, saying the older controller chip used in the ARC network has certain topological limitations.

Since standards have firmed up at the lower levels, manufacturers are now poised to move up the seven-layer ladder. Work is currently underway at several of the large IC houses to design IEEE-standard chips for message handling and error-detection protocols defined in the transport layer. "In spite of the varieties in software, [networking] is a communications business," says Lyle Pittroff of Advanced Micro Devices Inc, Sunnyvale, Calif., "so we like standards—and in the transport layer, it's here." According to Pittroff, AMD is examining what sorts of features and interfaces customers need and are willing to pay for. "We'd basically like to do it, but we must look at it as a business decision."

Motorola Inc., however, is not waiting. According to Tom Beaver, vice president and director of the Microsystems Operation at Tempe, Ariz., work on a transport-level IC is underway, and limited production quantities of the chip should be ready in 1985.

LSI solution

Along with the cost of interface units, whose prices will surely drop with the availability of LSI solutions (Fig. 5), a significant percentage of the total cost of installing local networks today goes into labor-intensive chores such as pulling cabling through already over-crowded cable trays and raceways and bashing holes in sheetrock to make a connection to a desk. A typical installation tap into a network today can run as high as $700 to $800, and if 25% of the nodes on a network must be moved in a year—a figure most experts agree is average—then how the network is implemented can mean big money to large users.

Recent announcements about cabling schemes from AT&T Co. and IBM reflect the importance that the computer giants have come to assign to the expense of cable installation, and it is one of the first battlegrounds in staking out market share. For example, in May, when IBM announced a cabling scheme for its eagerly awaited network, there was a brouhaha over the fact that the network is still two to three years away. AT&T waited a month for the noise to die down, then went one better by specifying cabling *and* announcing its packet-switching network architecture.

Actually, the two cabling schemes are very similar. Both AT&T's announced Information Systems Network and IBM's unannounced token-ring network depend on either a twisted-pair or high-speed fiber backbone to connect distribution panels in the wire closet; the distribution panel becomes the focus of a star that radiates a twisted-wire pair to the wall or floor socket (Fig. 6) .

Right now, all that IBM is delivering to its customers is different grades of cable, a set of instructions, a Lego-like connector system, and an embossed faceplate with separate attachment points for data terminal equipment and telephone handsets. The consensus among IBM-watchers is that the announcement was made to quiet the clamor of corporate building planners who know network cabling will be as ubiquitous as ac wiring within five years and want to be ready for IBM's local net. But if the IBM announcement left plenty of room for conjecture about how or even if voice and data will be integrated in the closet, AT&T's cabling scheme is easier to unravel.

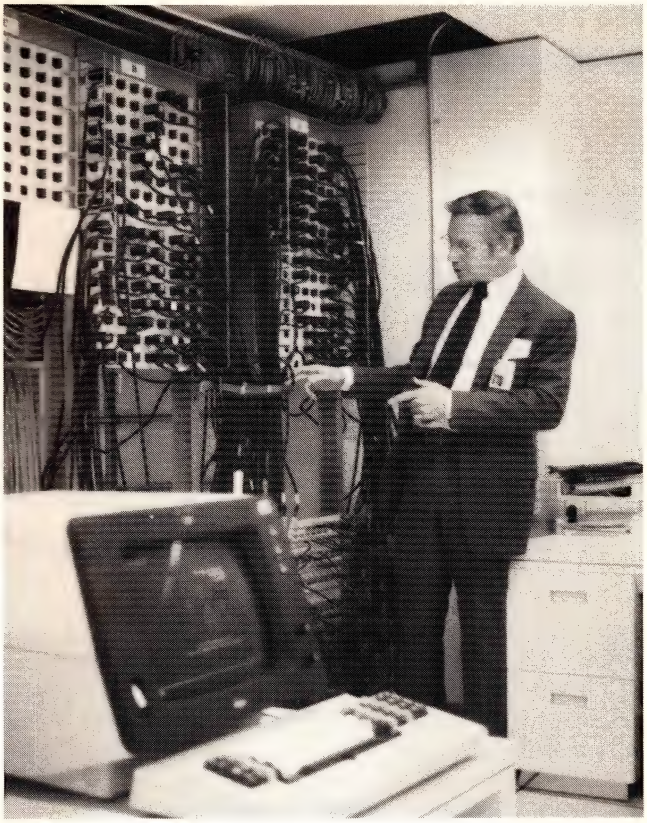
Voice and data

"We're making a big deal about handling voice and data," says Jim Edwards, a vice president at AT&T Information Technology in Morristown, N.J., describing the 8.64-Mb/s network that can be built around either the circuit-switching capability of a System 75/System 85 private branch exchange when data-handling requirements are low, or around a packet switch when data requirements are high.

"It's a strong product," says W. Spencer Rice, a specialist in local networks at S&R Consultants, Madison, N.J., of the AT&T network. "With twisted wire for low-end [computer-to-computer] connection, a gateway to their coax-based 3BNET, and fiber for high-speed, it's a nested networking solution with great price and performance characteristics. ISN will use in-place cable and eight-pin plugs that are in place right now."

However, while AT&T and IBM are busy lassoing Fortune 500 customers with their cabling schemes, tiny Mollard Systems Design Inc., San Jose, Calif., has come up with a transmission system for between 8 and 10 personal computers that it claims requires no new hard wiring and operates without a hard disk or dedicated network server. By broadcasting frequency-shift-keyed packets above 100 kHz across the ac power-distribution line, then using a software handshake between the receiver and sender to validate delivery, the company claims it has a reliable network that can provide such features as file locking and network directory. Stan Peters, vice president of marketing at Mollard, says, "It's not terribly economical for a small business to tear up carpet and wire every time a device is moved," so Mollard has developed its solution targeted at the small to medium-sized office.

If tearing up carpet is a headache for low-end users of local networks, then sympathy must be accorded the firms and institutions bulging with data that must be shipped across the street or to a building on the next block. If permission is granted to tear up the street for planting a coaxial or fiber cable—and if long-term use of the network is foreseen so that the expense is cost-effective relative to purchasing capacity from the telephone company or another carrier—then the sidewalks come up. But it is for the temporary linking of separate buildings that vendors of free-space, short-range optical data links have found their best sales niche, according to Lorraine Shallenberger, marketing manager for American Laser Systems, Inc., Goleta, Calif.



6. Out of the closet. Reconfiguring some 2,500 terminals at the new IBM office building in New York will be much easier using a recently announced cabling scheme, says T.J. Driscoll, a member of the planning staff for the 590 Madison Avenue project.

The laser route

Provided that fog—the nemesis of lightwave communications through free space—permits it, American Laser has a link that reaches out to 10 miles with laser-based transmitters. Transmission rates, however, are limited to 9.6 kb/s. For shorter distances—say within a mile and a half—a system based on light-emitting diodes puts out 3 Mb/s, making it attractive in linking dispersed data processing hubs or even local networks that need some degree of internetwork data exchange. Lightwave free-space systems are available from Modular Technology Ltd., Bicester, England; Light Communications Corp., East Norwalk, Conn.; LED Systems Inc., Mechanicsburg, Pa.; Datapoint Corp., and others.

A microwave link may provide yet another alternative to interconnecting a business that has outgrown the limitations of a single building, particularly if fog rolls in frequently. And the opening up of more frequencies at 23 GHz means that the required Federal Communications Commission license could be obtained easier or quicker (or both). Microwave link vendors include General Electric Co. Microwave Products Department, Owensboro, Ky., and Racon Inc., Seattle, Wash. ☐

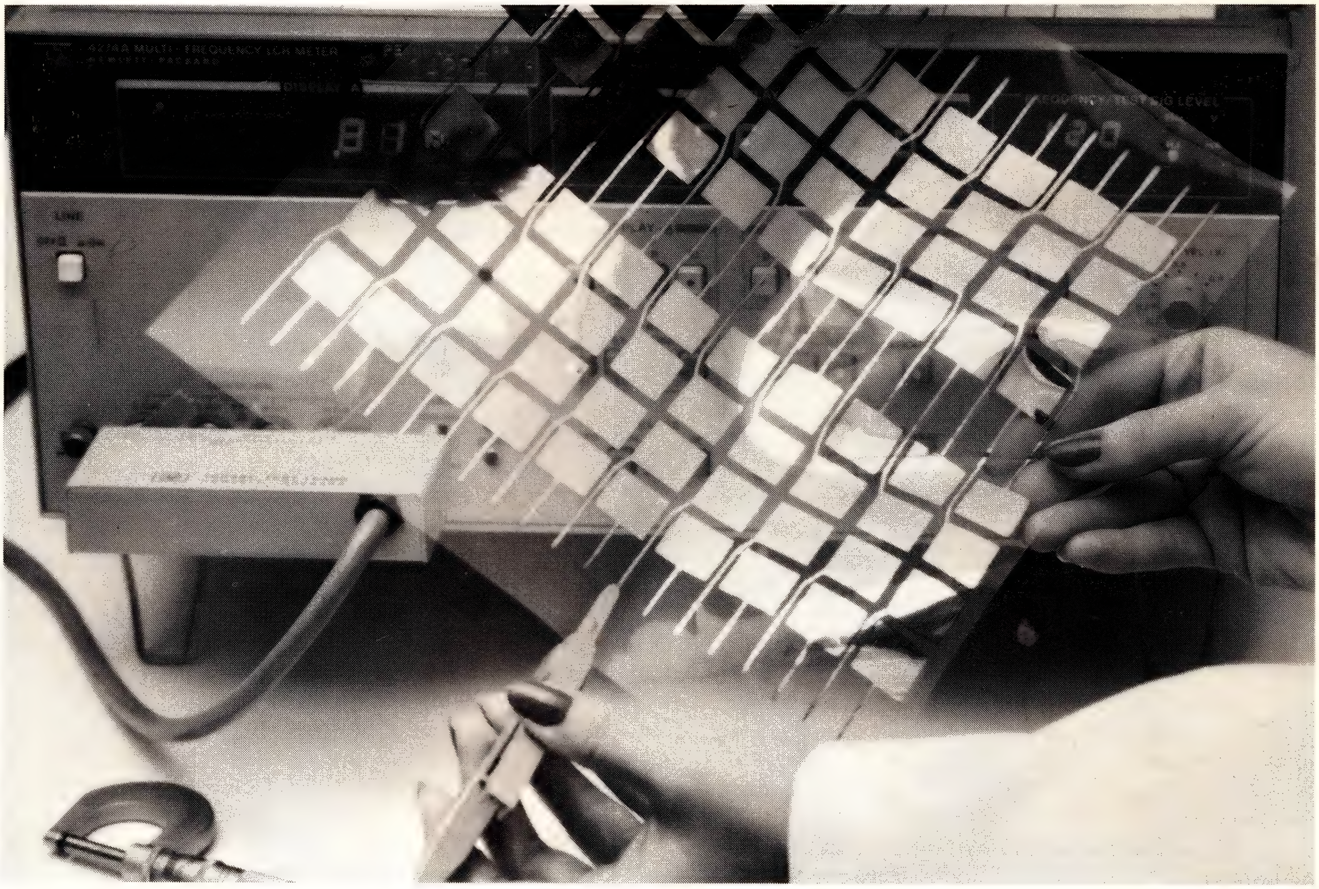
PIEZO FILM YIELDS NOVEL TRANSDUCERS

PVDF piezo film is pliant, tough, lightweight, and more sensitive compared to brittle and stiff ceramic

☐ *by J. Victor Chatigny*

A thin sheet of transluscent plastic film, with unique piezoelectric and pyroelectric properties, offers design engineers a transducer material applicable to numerous industrial, medical, and military uses. A thin sliver of the electrically active fluoropolymer film, for example, is a critical element in a new generation of highly effective noise-canceling microphones for lightweight telephone headsets. A novel respiratory gas flowmeter, using the piezo film, provides physicians with 34 different variables concerning a patient's lung mechanism and metabolism. Large sheets of the active film material can be used to convert the hulls of submarines into giant sonar antennas offering far greater range and sensitivity than available today.

A new piezo film called Kynar, available from Pennwalt Corp., offers design properties not previously available in other transducer materials or devices, including light weight, flexibility, response time in the nanosecond



1. Shaped to fit. Kynar piezo film can be shaped to form just about any desirable configuraton, while retaining its full piezoelectric and pyroelectric properties. The film is pliant and lightweight.

Piezoelectricity, pyroelectricity, and piezo film

Piezoelectricity—"pressure electricity"—is the capability of certain crystalline materials to change their dimensions when subjected to an electrical field or, conversely, to produce electrical signals when mechanically deformed. The piezoelectric phenomenon was first observed in natural quartz crystals by Pierre and Jacques Curie, who also predicted pyroelectricity, an electrical charge developed from a thermal change. The first practical use of the piezoelectric property of quartz was an ultrasonic underwater sending and receiving system, the forerunner of modern-day sonar.

Piezoelectricity is defined as electric polarization produced by mechanical strain in crystals belonging to certain classes, with polarization proportional to the strain and changing sign or polarity with it. The reverse is also true; an electrical polarization will induce a mechanical strain in piezoelectric crystals. Pyroelectricity is defined as electric polarization induced by thermal absorption in crystals, with polarization proportional to the thermal change. The opposite, electrocaloric effects, are of minor importance.

The deformation of a body of piezoelectric material from the application of an electric field and conversely, the nature of the deforming forces required to develop an electrical charge, depends on the type of piezoelectric material. Only certain cyrstals are piezoelectric or pyroelectric. The existence of a polar axis in the crystal gives rise to an inherent spontaneous polarization that is present before any electric field has been applied. The electrical charges developed by the piezo film decay with a time constant determined by the dielectric constant and internal resistance of the film, as well as the input impedance of the interface electronic circuits to which the film is connected.

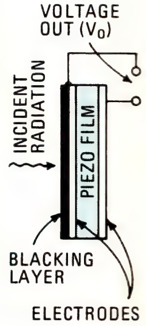
Quartz, Rochelle salts, and tourmeline were the earliest known highly polar natural piezoelectric crystals. Ceramics, such as barium titanate and variations of lead zirconate-lead titanate, with improved piezoelectric activity, have been synthesized. These materials are dense, brittle, stiff, difficult to produce in large sizes, and impractical to fabricate into complex shapes.

More recently, polymeric piezoelectric films have been developed, and these are flexible, tough and lightweight. Of all known polymers, those based on vinylidene fluoride show the highest piezo- and pyroelectric activities; polyvinylidene fluoride is the base resin used in the development of Kynar piezo film.

Laminates of the piezo film can be fabricated. A bending motion (analogous to a bimetallic strip in thermostats) can be generated in response to an applied voltage where the top film expands while the bottom film contracts. An alternating voltage produce a fan-like motion.

Kynar piezo film can also be used to detect thermal radiation. When thermal energy is absorbed by the PVDF, there is a corresponding rise in the temperature of the film that produced an electrical output. This pyroelectric action is linearly reversible upon cooling.

A pyroelectric detector, shown in the figure, consists of a thin semitransparent electrode placed on the front of the piezo film. The incident radiation passes into the piezo film, which absorbs strongly in the wavelength range of 8 to 11 μm; the thicker rear electrode is highly reflective. A blacking layer added to the front electrode results in far more efficient broadband absorption of incidental radiation.



Pyroelectric detectors made with piezo film are used in intrusion detection systems and energy management systems. Pyroelectric detectors can also be used for humidity monitoring and certain gas detection, a good example being carbon monoxide.

range, and frequency response from dc to over a gigahertz. The piezo film can be shaped and formed to just about any configuration while retaining its full activity (Fig. 1). High humidity conditions have no effect on its characteristics. It can be easily laminated to form multilayered bimorphs or multimorphs with resulting multiplication in transducer response levels.

The piezoelectric effect of Kynar polyvinylidene fluoride (PVDF) film is extremely stable (see "Piezoelectricity, pyroelectricity, and piezo film"). Its poled internal structure remains stable under all but the most extreme conditions of temperature, mechanical shock, or externally applied voltage. It requires a temperature over 120°C (about 250°F), or several thousand volts, or impact of several hundred Gs in order to depole the activated film. The film is not inherently a power-handling device but is an excellent trigger device to monitor and control power-operated devices.

Kynar piezo film is a polymeric material with mechanical properties typical of rigid engineering plastics and provides high chemical resistance (PVDF is widely used by the chemical industry for pumps and pipes). The material is tough, lightweight, transparent, flexible, and readily manufactured in sheet form in a continuous roll process or fabricated into complex shapes for specific applications. Piezoelectric cable, for example, has been manufactured for hydrophone and geophysical transducer applications. The piezo film is compliant and will readily adhere to supporting structures of complex geometry or suspended as a membrane in a preset shape.

The rigidity of ceramics is much greater than polymers. Although this rigidity offers an advantage when converting electrical energy to mechanical vibration, ceramics are also brittle and stiff and therefore difficult to produce in large sizes and impractical to fabricate into complex shapes.

Piezo film is more sensitive than quartz and far more sensitive than ceramic as a transformer of mechanical to electrical energy. Consequently, polymeric and ceramic piezoelectric materials are more complementary to piezo film than they are competitive.

Temperature dependence and aging characteristics of piezo film are important design parameters that have been studied extensively. The decay of piezo film's activity is proportional to working temperature, with no substantial decay in activity up to a working temperature of 70°C; high activity (50% of initial value) is maintained at 110°C.

Table 1 lists the mechanical and electrical properties of Kynar piezo film while Table 2 compares several key properties of Kynar with those of other piezo- and pyroelectric materials.

TABLE 1: TYPICAL PROPERTIES OF KYNAR PIEZO FILM

Property		Value	Units
Thickness		6 – 125	μm
Surface conductivity of metallized film	Al	1 – 4	$\Omega\square^{-1}$
	Ni	10 – 25	
Static piezoelectric strain constant	d_{31}	20 – 25	pCN^{-1} (pmV^{-1})
	d_{33}	–20 – 22	
Static voltage output coefficient	g_{31}	0.230	VmN^{-1}
	g_{33}	–0.210	
Electromechanical coupling factor	k_{31}	9 – 15	% at 100 Hz
Pyroelectric coefficient	p	–23 – 27	$\mu Cm^{-2}\ {}^{\circ}K^{-1}$
Relative dielectric permitivity	ϵ/ϵ_0	12 ± 1	at 1,000 Hz
Dielectric loss factor	tan δ	0.015 – 0.02	at 1,000 Hz
Volume resistivity	ρ	10^{13}	Ωm
Melting point		165 – 180	°C
Thermal conductivity		0.13	$Wm^{-1}\ {}^{\circ}K^{-1}$
Density		1.8	$g\ (cm)^{-3}$
Thermal expansion coefficient		1.4	$10^{-4}\ {}^{\circ}K^{-1}$

The thermal characteristics of piezo film, shown in Fig. 2a, illustrates how piezo activity remains extremely stable after initial decay. Most of the decay below 120°C is caused by thermally induced mechanical relaxation and is not related to depolarization effects. The solid line in Fig. 2b indicates the temperature dependence of the pyroelectric constant, p, in PVDF film when used at 50°C or lower. When the film is subjected to temperatures above 50°C, the pyroelectric constant permanently decreases, as shown by the dashed lines. A higher annealing temperature can be used to stabilize the film in applications where it will be exposed to operating temperature excursions above 50°C, but below the annealing temperature. As long as the film is used below the annealing temperature, it will maintain the decreased pyroelectric activity identified by the dashed lines in Fig. 2b.

Flexible configuration

Temperature exposure higher than 120°C is not recommended. At operating temperatures below –40°C, piezo activity will be greatly reduced, since this is the glass transition temperature for the material. Reheating the film above 40°C, however, will return the piezo activity and pyro activity. Therefore, nonoperational conditions, such as storage below –40°C will not permanently degrade performance.

In contrast to a conventional ceramic transducer, piezo film has a low Q (about 10) and has been employed at frequencies from dc up to 10 GHz. The flat frequency response over a wide range is a consequence of the polymer's softness, which eliminates the self-ringing found in brittle materials. The basic thickness resonance of a free-standing sheet of 28-μm PVDF is approximately 40 MHz. By varying the thickness or creating multilaminates, the basic resonance can be brought down to low megahertz range for very thick films (1 mm) and up to 1 GHz for very thin films (1 μm). The relationship between electrical impedance and frequency for various thicknesses of Kynar piezo film (Fig. 3) is important for matching film impedance to associated components in the circuit.

Transducers made of PVDF film are thin, flexible, and have low density and excellent sensitivity, yet are mechanically tough. The compliance of piezo film is 10 times greater than the compliance of ceramics. When machined into very thin film, piezo film can be directly attached to structures without disturbing the mechanical motion of these structures. Its low impedance permits the efficient transfer of energy to air or other gases.

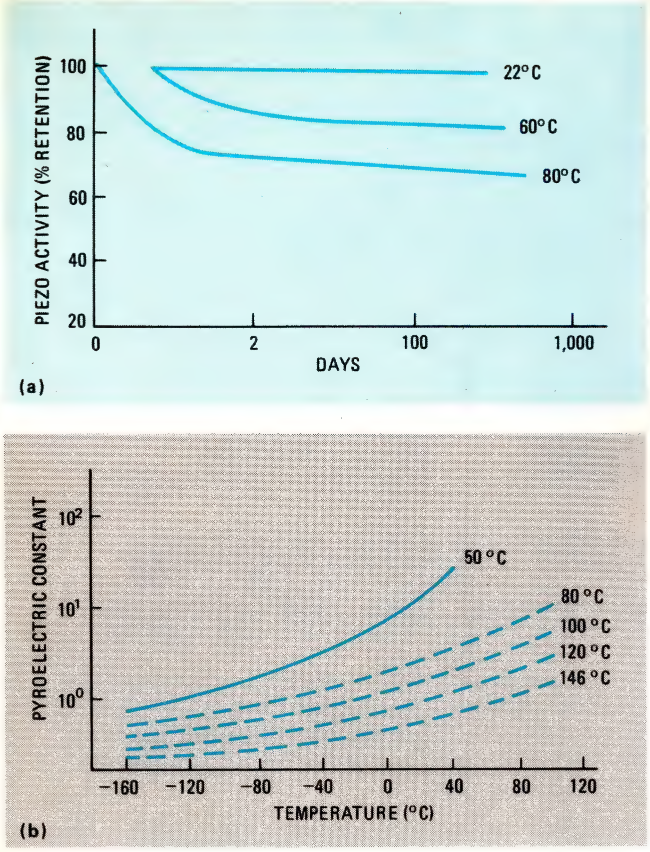
The acoustic impedance of piezo film is 2.3 times higher than water, compared to 16 times for ceramic. A good acoustic impedance match to water means that an acoustic signal will pass through the piezo film without being appreciably scattered or reflected.

Dielectric losses limit the power handling capability of transducers. Some piezoelectric materials—quartz, for example—are high-quality dielectrics. Piezo film has a dielectric strength 70 times greater than lead-zirconate-titanate (PZT). The breakdown voltage for 28-μm film is about 2,000 V.

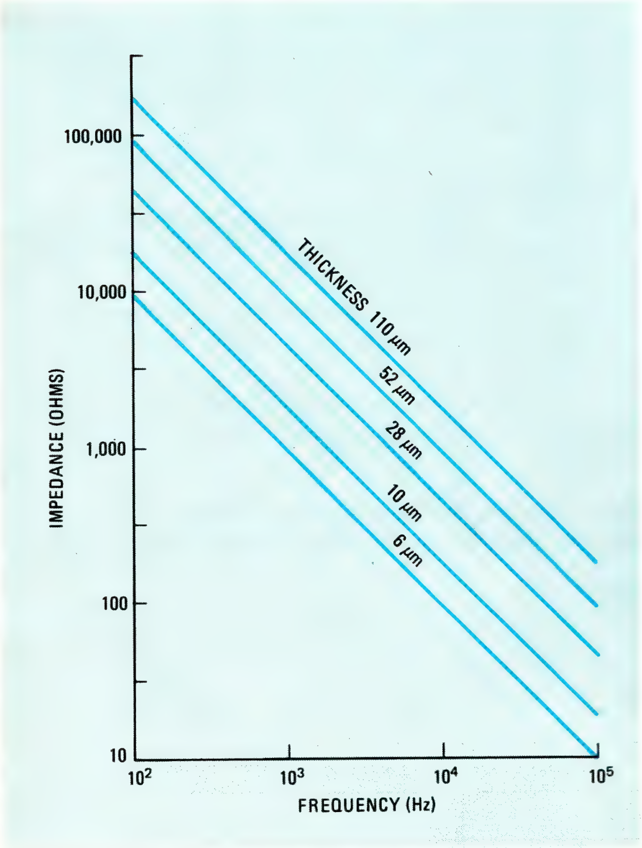
Piezo film is a highly sensitive material and is subject to extraneous electromagnetic interference signals. The broadband nature of piezo film makes it susceptible to low-frequency emi sources (60-cycle fluorescent light) and to higher frequency interference. A simple method

TABLE 2: COMPARISON OF PROPERTIES OF PIEZOELECTRIC AND PYROELECTRIC MATERIALS

Materials	Cut	Density	Elastic stiffness	Relative dielectric constant	Piezoelectric constant				Coupling factor	Acoustic impedance
		ρ kg/m^3	c $\frac{N\,(Newtons)}{m^2}$	ϵ/ϵ_θ	d m/V	e N/Vm $(\times 10^{-2})$	g Vm/N $(\times 10^{-3})$	h V/m (10^7)	k (%)	z kg/m^2 - s
Rochelle salt	45%	1.77	17.7	350	275	490	90	160	73	5.6
Triglycine sulfate		1.69	30	45	25	—	—	—	—	—
PBLG	45Z	1.3	3	3.8	2	—	—	—	2	2
PZT	Z	7.5	83.3	1,200	110	920	10	90	30	30
$BaTi_2O_3$	Z	5.7	110	1,700	78	860	5.2	60	21	30
KYNAR film	Z	1.78	3	12	23	6.9	200	65	12	2.5



2. Temperature dependence. After initial decay, piezo activity remains extremely stable over an extended time period if temperature is not varied (a). The pyroelectric constant permanently decreases when subjected to temperatures above 50°C (b).



3. Impedance characteristics. The relationship between electrical impedance, Z, and frequency for various thicknesses of piezo film is useful for matching film impedance to circuit components. The film area is 100 cm² for the data shown.

for mitigating emi is to shield the hot side of the piezo film device within a conductive enclosure using conductive paint or foil, or a conductive chamber while connecting the other side of the device to ground.

The piezo film can be adhered to a structural member using nonconductive or conductive adhesives. Nonconducting adhesives are used when electrical connection is made directly to the piezo film electrodes. Conductive adhesives provide direct electrical contact between the piezo film metalized surfaces and conductive structural members to which leads have been attached. Conductive elastomers can be applied to the interface of a conducting structure and the film to form a conductive bridge.

Selection of adhesives for Kynar piezo film depends on the surface of the material to which the film is to be adhered and the desired mechanical properties of the adhesive layer. In all cases, however, adhesives should be chosen that are nonpolar and have low dielectric constants. Adhesives based on toluene, xylene, aliphatic hydrocarbons, and aromatic hydrocarbons are suitable. Highly polar, high-dielectric-constant adhesives such as acetones and alcohol-based formulations can attack the PVDF film and should not be used. Acrylics, urethanes and epoxies are suitable nonconductive adhesives.

Piezo film pricing currently varies considerably with quantity ordered. Sample prices range from 10 to 50 cents per square centimeter depending on thickness; production quantity pricing depends on volume, film thickness, and electrode configuration. Since piezo film is readily fabricated into thin sheets of large surface area, its price is about one tenth of piezo ceramic for an equivalent area of material.

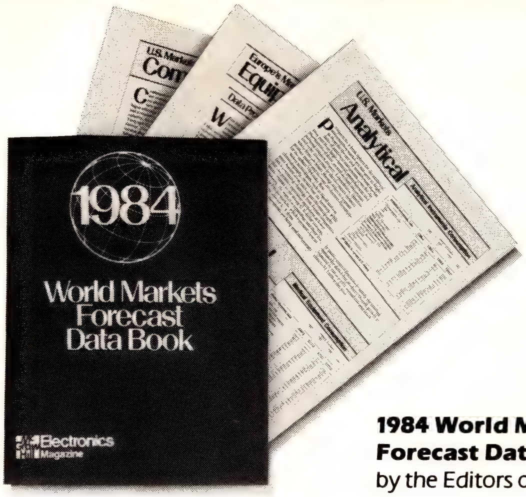
Versatile applications

Kynar piezo film can be fabricated into a large number of different shapes and sizes by simple techniques. Applications include acoustic, underwater, and pyroelectric transducers, pressure switches, and electro-motional devices. Acoustic transducers such as microphones, stereophonic headphones, high-frequency speakers, tone generators, acoustic modems, and phonograph cartridges have been designed with Kynar piezo film. Underwater transducers have been constructed making use of piezo film's acoustic impedance being close to that of water.

The low heat capacity of PVDF provides a rapidly responding thermal detector for infrared and millimeter waves. The advantages of piezo film pyroelectric detectors are moderately high operating temperatures, toughness of the thin films, moisture insensitivity, chemical inertness, and low cost. Pyroelectric applications include temperature monitors, fire alarms, intrusion detection systems, and copying equipment. Bimorphs and multimorphs of piezo film develop large amounts of bending for relatively low applied voltages useful for visual displays, electric fans, and light shutters. ☐

J. Victor Chatigny is manager of the Kynar Piezo Group, Pennwalt Corp, King of Prussia, Pa.

Just Published
Revised Updated



1984 World Markets
Forecast Data Book
by the Editors of ElectronicsWeek

Forecasting Analysis of Changing Demands in the Electronics' Market

The all new and revised edition of the 1984 World Markets Forecast Data Book is now available!

In its new format and design, this exclusive report offers you a worldwide research effort, conducted by the editors of ElectronicsWeek.

Covering more than 800 products in 13 countries, this comprehensive and authoritative forecast is an essential tool for those seriously concerned about changing market demands.

The 26th annual market forecast gives an analytical profile using descriptive tables and charts. The 1984 edition covers current and future market demands in the USA, Western Europe and Japan. There are over 40 pages of in depth data on the outlook for 845 electronics products in the categories of: semiconductors • components • communications equipment • data-processing and office equipment • industrial electronics • consumer electronics • test and measurement equipment.

Immediately acquire the investigative research statistics from ElectronicsWeek's highly experienced editors. There are 20 additional pages of market-estimates and growth-rate data tables. The topics include:

- Compound annual growth rates for 1982-1987 for U.S.
- U.S. and Europe report research methodologies
- Industry summary for all markets
- Country-by-country, product-by-product market estimates for Belgium, Denmark, France, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom and West Germany.

Covers a broad range of extremely important information on:
U.S. market estimates and growth rates for semiconductors and 15 other components categories, consumer, federal and industrial electronics and commercial equipment.

Western Europe country-by-country consumption breakdown for 84 types of electronic equipment and 46 components.

Japan's changing demand for 89 equipment products, 59 components and the semiconductor market through the year 1987.

Page after page, this investigative report offers a solid base of valuable information and detailed analysis essential to decision-makers and researchers in the electronics market.

Order your copy today for immediate delivery!

ElectronicsWeek Books
McGraw-Hill Inc.
Princeton Road
Hightstown, N.J. 08520
(Tel.) 609/426-5070

ElectronicsWeek Books European Circulation Center
McGraw-Hill Publications Co. Shoppenhangers Road
Maidenhead, Berkshire SL6 2QL England (Tlx.) 84884

Mc Graw Hill

Send me ________ copy (copies) of **ElectronicsWeek's 1984 World Markets Forecast Data Book** at $175 each, plus local sales tax in USA. Full payment must accompany order, or a pro forma invoice will be sent upon request. Price includes first-class mail in North America, air shipment elsewhere. WMF-84

Name
Title or dept.
Company
Address City
State or country Zip (USA)

NOW COMDIAL WAFER TEST

Fast response testing. Both 4 and 5 inch wafers.

Now Comdial also offers fast response scheduling of automatic testing for four and five inch wafers. And a full array of test services, including engineering rental time.

Test facilities include Series 20 LSI and Series 10 LSI testers, Electroglas 2001 XMA wafer sorters with auto alignment, Symtek 7936 HC-48 handler for dual-in-line packages.

Automatic handling, increased throughput, higher yields—testing scheduled to fit your production requirements.

All part of Comdial's commitment to responsiveness, from fast turn film photoplate coordination and prototype fabrication through scheduled volume production and packaging.

Comdial handles it all—at your convenience. Fast. Responsive.

Call Gary Kennedy, Vice President and General Manager, for information.

COMDIAL

Technology Division
Semiconductor Services

U.S.
1230 BORDEAUX DRIVE
SUNNYVALE, CALIFORNIA 94089
TELEPHONE (408) 744-1800
TWX (910) 339-9307

Circle 79 on reader service card

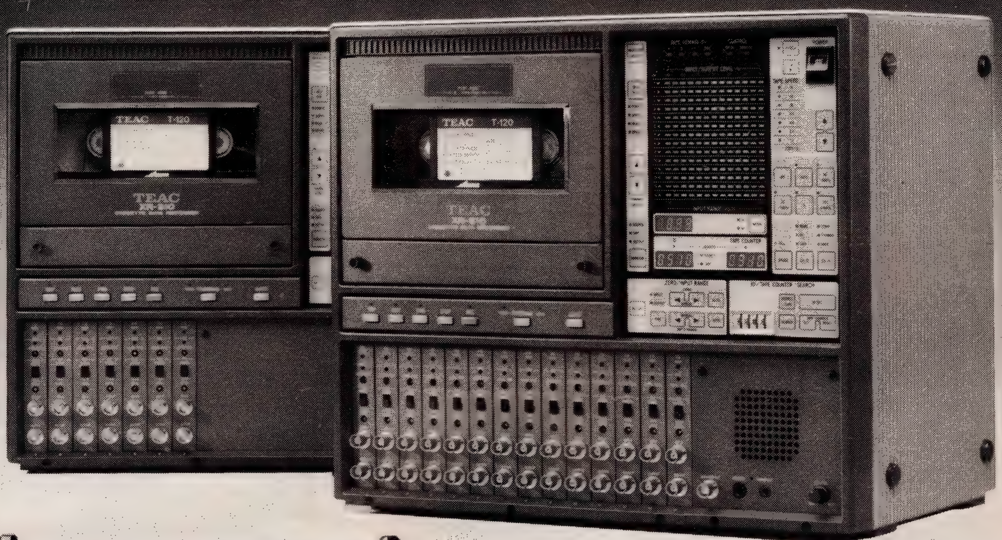
TEAC Puts More Versatility in Data Recording

XR-310
XR-510

Videocassette format with extensive microcomputer control.

The XR-310 and XR-510 data recorders offer 7 and 14 data tracks plus a memo announce channel, respectively, on 1/2-inch videocassette tape. Thanks to extensive computer control, they provide high quality performance and unmatched operation ease. Compatibility with the XR-30 and XR-50 gives you greater system flexibility.

■Computer control using three microprocessors. ■Auto Program Loading function sets pre-record conditions. ■Centralized control panel with flat-panel switches. ■One-touch Self-Check function. ■Bar-graph type LED level meters. ■Optional GP-IB interface.



XR-30/50/70

Multi-speed, multi-channel capability with easy portability.

These three portable data recorders provide the multitrack capabilities and performance of open reel recorders with the convenience of cassette recorders. They have four selectable speeds with 8, 15, and 22 channels, respectively, and use 1/2-inch videocassette tape.

■Wide-bandwidth FM recording system standard, DR option available on XR-30 and XR-50. ■Two-way (AC/DC) power supply capability with optional DC power supply unit. ■Independent rec/reproduce heads for tape/source monitoring. ■Tape servo and noise compensation channels.

TEAC

TEAC CORPORATION: 3-7-3 Naka-cho, Musashino, Tokyo, Japan Tel: (0422) 53-1111

■**U.S.A.** TEAC Corporation of America, Tel: (213) 726-0303 B.J. Wolfe Enterprise Inc., Tel: (213) 877-5518 ■**Canada** R.H. NICHOLS CO., LTD., Tel: (416) 661-3190 ■**New Zealand** McLean Information Technology Ltd., Tel: 501-801 ■**Australia** Electrical Equipment Ltd., Tel: 597 1155 ■**Hong Kong** Nissei Sangyo Co., Ltd., Tel: 3-343441-6 ■**South Africa** SPESCOM (PTY) LTD., Tel: 836-9181 ■**United Kingdom** INTERNATIONAL RECORDERS LTD., Tel: 04427 5959 ■**West Germany** nbn Elektronik GmbH., Tel: 08152/390 ■**Holland** Simac Electronics B.V., Tel: 040-533725 ■**Belgium & Luxemburg** Simac Electronics S.P.R.L., Tel: 02-219.24.53 ■**France** Tekelec Airtronic S.A., Tel: (1) 534-75-35 ■**Italy** A.E.S.S.E.s.p.a. Tel: 54.64.741-2-3 ■**Spain** Ataio Ingenieros S.A., Tel: 733 0562, 733 3700 ■**Denmark** Dansk Binær Teknik A/S, Tel: 03-662020 ■**Sweden** teleinstrument ab, Tel: 08-380 370 ■**Norway** METRIC AS, Tel: (02) 611070 ■**Finland** INSTRUMENTARIUM ELEKTRONIKKA, Tel: (90) 505-2255

** If no distributor is listed above in your area, please contact us directly for further details about our products.*

Circle 114 on reader service card

68008 CHIP GIVES EXORBUS 16-BIT POWER

The 68008 microprocessor allows high-speed asynchronous operation in EXORbus-based development systems ☐ *by Steve Zollo*

An EXORbus single-board computer module—packing 65-K bytes of on-board memory, two serial and two parallel ports, an IEEE-488 port, and an Opto-22 port—offers users a choice of a 16- or an 8-bit microprocessor as its heart. This makes the GMS6507 the only EXORbus module to offer the 68008 16-bit microprocessor, according to Benjamin K. Sharfi, General Micro Systems president.

The EXORbus structure was designed for 8-bit processors. The company can also supply a module with such 8-bit processors as the 6809, Z80, 6502, or 9900 in 1- or 2-MHz versions.

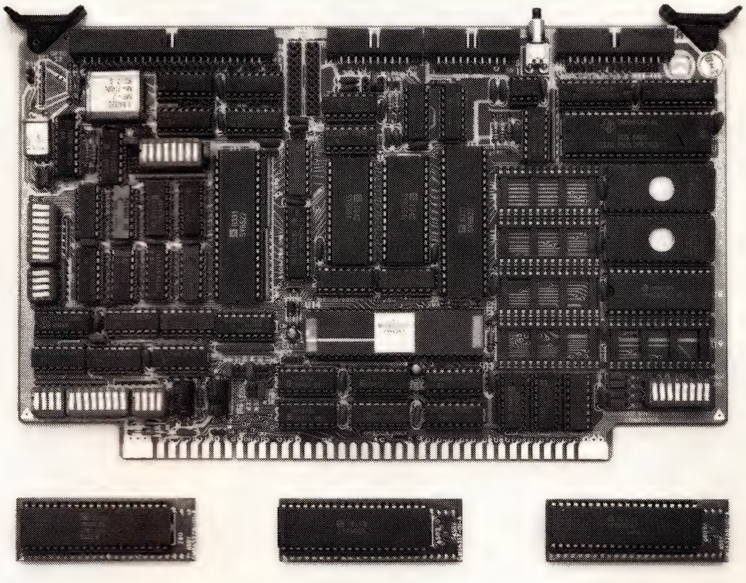
The 68008 16-bit processor teamed with the 8-bit data EXORbus structure allows memory operations to occur asynchronously at maximum speed (at an 8- or 10-MHz rate) and input/output transfers to occur synchronously for ease of communication and lower overall system cost. The EXORbus module can be included in a two-board 6809 development system; existing systems using the 8-bit data EXORbus can be upgraded to 16-bit processing power by replacing the central processing unit card with the GMS6507, Sharfi says.

The module has extensive digital I/O capabilities. Its two serial RS-232-C ports come with 15 programmable baud rates. The two parallel printer ports can be traded for one parallel port and an additional 10 user-programmable I/O lines. In addition, 20 bidirectional, fully buffered I/O lines can each drive 48 mA for use with industrial I/O modules such as the Opto 22. Rounding out the I/O capabilities, the IEEE-488 port can be used to control an IEEE-488 bus or as a talker or listener only. All peripherals and the IEEE-488 bus mate with on-board connectors through a single one-to-one ribbon cable, thus avoiding break-out modules or user-customized cables.

The module's I/O and memory are switch-selectable for base address with enable and disenable. The memory section provides eight byte-wide sockets that can accept 2-K-by-8-bit or 8-K-by-8-bit random-access memories, read-only memories, or erasable programmable ROMs. Each chip may be disabled through dual in-line package switches, or the entire memory may be disabled under software contol.

All I/O devices are interrupt-driven and can be strapped to interrupt-priority-level logic for ease of programming. To use this module with existing EXORbus modules, a switch-selectable 64-K-byte bank may be allocated for all synchronous hardware.

Translators. By merely adding CPU translator sets, which can be plugged into the same socket that accepts the 68008, the same board can be reconfigured with either a 6809, Z80, 6502, or 9900 microprocessor. Extended addressing and bank switching signals are generated



Introducing the newest member o

The HP 1630G...65 channels an maximize 16-bit systen

First came the HP 1630A and the HP 1630D. One, a low-cost general purpose logic analyzer suited to the needs of the full development cycle. The other, with 16 channels of timing analysis and 27 of state, an invaluable tool for the hardware design engineer. Now Hewlett-Packard introduces the HP 1630G. With up to 65 channels of state analysis, it is the new standard for software design engineers working on complex new 16-bit microprocessor-based products. Plus, the ability to configure 8 of those lines for 100 MHz timing analysis gives you a logic analyzer system with investigative power and versatility for virtually all your needs.

Three new software overview modes let you nonintrusively monitor software performance and hardware/software interactions in real time.

The HP 1630G significantly expands on the software performance capabilities already introduced in the HP 1630A/D family members. In addition to time histograms that show execution-time distribution, and label histograms that show address activity, the HP 1630G gives you three new modes: program flow, time positional, and linkage measurements. *Program flow measurement* lets you monitor program activity based strictly on opcode accesses. This can help resolve confusions which may occur when histogramming by address, especially if the program generates inline code or if memory blocks are interspersed between sections of the program. *Time positional measurement* lets you measure the number of occurrences of an event per unit time. Use this to better understand the behavior of your system under a time-varying load. *Linkage measurement* measures the relative frequency of the activity between specific software modules. You'll find this mode invaluable when you want to monitor the transfer activity between a main program and a series of subroutines, for example. Take advantage of all these software performance analysis modes to rapidly

HP-IL

DESIGNED FOR
HP-IB
SYSTEMS

HP-IB: Not just IEEE-488, but the hardware, documentation and support that delivers the shortest path to a measurement system.

```
State Listing_____________________________________

Label>    ADDR          8085 Mnemonic          STAT
Base >  [ REL+HEX  ]  [        ASM         ]  [ USR ]

[Mark ] [STACK]+004E  [    Instructions    ]  [MEMRD]

+0021    KEYBD  +000E  MOV   B,A               OPFCH
+0022    KEYBD  +000F  JNC   KEYBD             OPFCH
+0023    KEYBD  +0010    D0  memory read       MEMRD
+0024    KEYBD  +0011    01  memory read       MEMRD
+0025    KEYBD  +0000  XRA   A                 OPFCH
+0026    KEYBD  +0001  OUT   28                OPFCH
+0027    KEYBD  +0002    28  memory read       MEMRD
+0028    SCAN   +0000    00  i/o write         IO WR
+0029    KEYBD  +0003  MOV   A,M               OPFCH
+0030    STACK  +004E    C7  memory read       MEMRD
+0031    KEYBD  +0004  OUT   38                OPFCH
+0032    KEYBD  +0005    38  memory read       MEMRD
+0033    DSPLY  +0000    C7  i/o write         IO WR
+0034    KEYBD  +0006  MOV   A,B               OPFCH
+0035    KEYBD  +0007  OUT   28                OPFCH
+0036    KEYBD  +0008    28  memory read       MEMRD
```

HP 1630D

HP 1630A

P's logic analyzer family.

dvanced software analysis help you erformance.

discover if your system is resource-limited or if, for example, poorly chosen program segmentation is causing too much time-consuming disc-to-memory swapping.

Time tagging gives you added insights into system functions.

In the state analysis mode, time tagging measures the time elapsed between each stored state. Make detailed absolute time measurements between states and known physical events. Or, use the mode to measure the total time from the trigger point to a particular state. Because time tagging is a single-pass activity, it is well suited to helping you identify inline sections of code that take longer to execute than anticipated.

Floppy disc interface and popular 16-bit microprocessor support.

On-board non-volatile memory keeps one instrument setup and your current disassembler instantly available at power-up. For even greater storage, the HP 1630G features direct compatibility with a number of HP disc drives such as the HP 9121S/D (the HP 9121D is illustrated). In one convenient 3 1/2'' floppy you can now store data, state listings, timing diagrams, alternate disassemblers, and instrument setup configurations. For added flexibility, the HP 1630G supports all popular 8-bit, as well as the following 16-bit microprocessors: 68000, 8086, 8088, 80186, 80286, Z8001 and Z8002.

Our HP 1630G upgrade kit protects your previous HP investment.

If you've already invested in an HP 1630A or HP 1630D, but you feel you need the added capabilities of the HP 1630G, you'll be glad to know that an upgrade kit is available.

Compare the HP 1630G. At $12,100* it's even HP-IB programmable for fully automated measurements. To find out more about the HP 1630G or its companions the HP 1630A/D, call your local HP sales office listed in the telephone directory white pages. Ask for the electronic instruments department.

* U.S.A. list price only.

HP 1630G

HEWLETT PACKARD

0801403

Circle 83 on reader service card

when the translators are used. In 64-K-byte systems, the I/O address may overlap memory.

Another translator is available to plug into the IEEE-488 socket. It supplies a real-time, battery-backed clock, calendar, and RAM in place of the IEEE-488 port. A precision threshold detector and write-protect circuitry are also included.

The module accommodates power-on reset and external reset switches. It buffers all address, data, and control signals, which are brought to the edge connector, with three-state buffers with direct memory access. In addition, the GMS6507 is fully socket-protected against overvoltages and reverse polarity, and is burned in for 72 h.

Software available in ROM includes a Unix-like language for the 68008 and 6809 processors, OS9 and Uniflex for the 6809, CP/M for the Z80, and the standard operating system software for the 5602. Priced at $685 each without memory chips, the GMS6507 is available now, with standard discounts for original-equipment manufacturers.

General Micro Systems Inc., 1320 Chaffey Ct., Ontario, Calif. 91762. Phone (714) 625-5475 [Circle reader service number 338]

ARTIFICIAL INTELLIGENCE

High-performance four-user system that runs under Lisp brings down the cost per user

The trend toward lowering costs in the computer industry extends to specialized segments as well. Continuing its quest for reduced costs per user for high-performance artificial intelligence machines, Lisp Machine Inc. is introducing a new four-user version of its Lambda family of AI computers.

Unveiled at this week's meeting of the American Association for Artificial Intelligence, in Austin, Texas, the Lambda 4X4 is a four-station, four-processor AI system offering one of the best price-performance alternatives to AI system developers.

In fact, the company says that the Lambda 4X4's low per-user cost makes it especially notable. "Prior to our development of multiuser Lisp Machines, the high cost of single-user systems had greatly limited the use of this technology for research and commercial applications," says Frank Spitznogle, Lisp Machine's president and chief operating officer.

The Lambda family, which also includes single- and dual-user models [*Electronics,* April 5, 1984, p. 42], is built around the 37.5-megabyte/s NuBus parallel-processing architecture originally developed at the Massachusetts Institute of Technology, turned into a product by Texas Instruments Inc., and then taken on by Lisp Machines.

This multiprocessor NuBus architecture brings flexibility, modular growth, and cost savings through resource sharing to the field of AI software design and development. In the new Lambda 4X4, the standard 4-megabyte main memory (expandable in 2-megabyte increments) is segmented among the four Lisp/Prolog processors; other system resources include a 470-megabyte disk drive, optional Multibus peripherals, and an Ethernet II interface.

Supplied with the system is a complete Lisp software environment. Currently the most popular AI symbolic programming language, Lisp is represented on Lambda machines by a rich programming environment called Zetalisp-Plus. Prolog, which is an AI logic-programming language gaining in popularity, is an option from Lisp Machines and comes in a version called LM-Prolog.

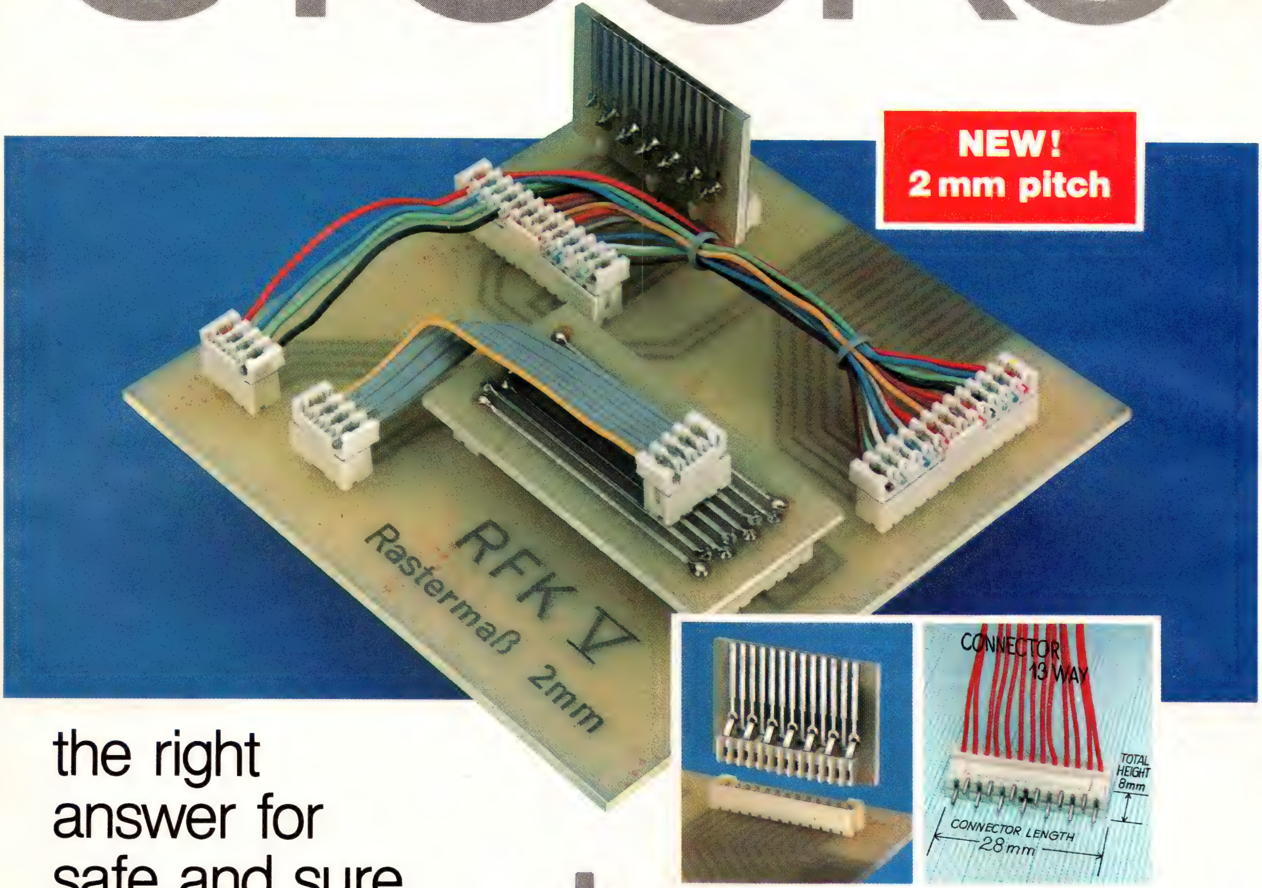
The cost of a full four-processor Lambda 4X4 system with four user work stations ranges from $40,000 to $50,000 per user, depending on the memory and peripherals configuration. Field upgrades of single- and dual-processor systems are available but not yet priced. Deliveries are scheduled to begin in October.

Lisp Machine Inc., 6033 W. Century Blvd.,
Los Angeles, Calif. 90045.
Phone (213) 642-1116 [Circle 398]

A $15,000 artificial intelligence system runs Smalltalk-80 language, is built around a 68010

A $14,950 computer that runs the Smalltalk-80 programming language marks Tektronix' entrance into the artificial intelligence market. To hit the market early next year, the 4404 Artificial Intelligence System is designed to increase productivity in many areas of AI research and devel-

STOCKO



the right
answer for
safe and sure

contacts

STOCKO Miniature connector system RFK V 2 mm contact spacing

This new miniature connector system RFK V was specially developed for compact electronics applications and represents a complete system for printed circuit application.

Special Features:
- Horizontal, vertical and Sandwich assembly
- Applications: wire/board and board/board
- Insulation displacement, crimping and solder terminations
- Total height 8 mm (socket plus pin housings)
- No. of ways: 2—15
- Polarising features
- Wire size 0,07—0,13 mm²
- Temperature range: — 40 °C to + 120 °C

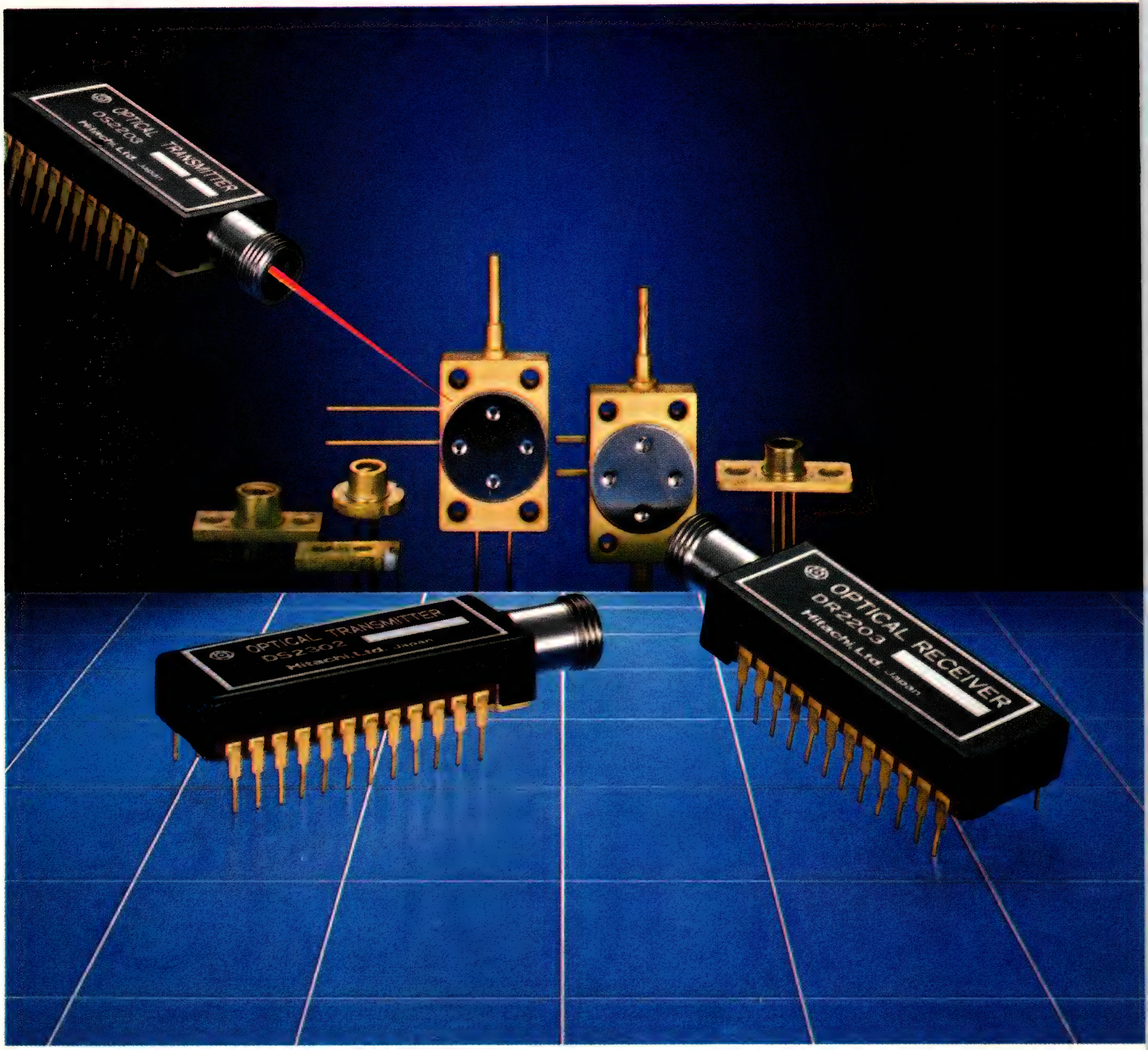
The RFK V connector system is the right choice where smallness is of importance

STOCKO

STOCKO Electrical-Electronics Division
D-5600 Wuppertal 1 · P.O. Box 13 01 53
Telephone (02 02) 7 49 30 · Telex 8 591 347 sto d · Teletex 202 316 sto wup

Representations worldwide · Subsidiaries in Belgium, France, Great Britain, Switzerland, Spain, Tunisia and U.S.A.

Circle 115 on reader service card



Hitachi laser diodes of all types and outputs, plus fiber optic modules capable of high-efficiency, high-volume data transmission—the right products for any application.

FOR THE LASER DIODES AND FIBER OPTIC PRODUCTS YOU NEED, EXACTLY AS YOU NEED THEM, LOOK TO HITACHI AND THE LINE-UP THAT'S

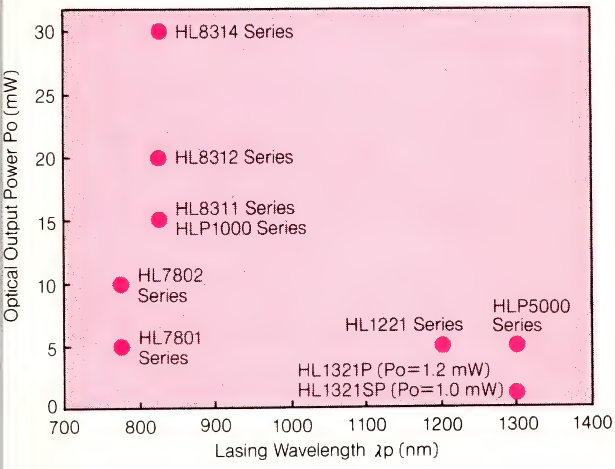
VERSATILE

Optical fiber networks, laser-beam printers, laser pickup systems...all benefit from Hitachi's wide variety of high-quality products. Because these devices and components are based on our pioneering technologies for optics, semiconductors, ultra-precise machining and assembly. So whether you require laser diodes or fiber optic modules, you're sure to find the specific device you require in the Hitachi line-up.

A full range of laser diodes

Hitachi provides a complete array of laser products for sophisticated equipment development. They feature such remarkable properties as small size, light weight, low power consumption, high collimating efficiency, monochromaticity and high-speed direct modulation capability.

Hitachi Laser Products Line-up



Select Hitachi's high-power products providing outputs up to 30 mW for memory discs with mass storage and quick random-access capabilities. Or variable independent peak wavelength products (780, 830, 1200 and 1300 nm) for communications equipment, information terminals, disc systems, measurement equipment, medical appliances, and much more.

These diodes come in a variety of packages, each one the product of Hitachi's most advanced technology and extensive R&D capabilities.

Innovation in fiber optics

The trend in data processing is away from stand-alone equipment toward totally integrated systems—local area networks for offices, factories and laboratories. And Hitachi fiber optic systems and components provide optimum efficiency in these applications, for speedier, higher-volume transmission of data.

Hitachi fiber optic transmission modules, for example, combine a variety of key functions in compact, single-chip LSI transmitter/receiver packages. They reduce space requirements, increase ease of installation, and provide high reliability over a wide range of data rates.

So if you are looking for systems and components that will be serving the business and industry of tomorrow and beyond, look to Hitachi for exceptional products with proven versatility.

HITACHI

For more information:
Hitachi, Ltd., Semiconductor & IC Div., New Marunouchi Bldg., 5-1 Marunouchi 1 chome, Chiyoda-ku, Tokyo 100, Japan, Tel: Tokyo (03) 212-1111, Telex: J22395, J22432,
J24491, J26375 (HITACHY), Cable: HITACHY TOKYO **Hitachi Electronic Components Europe GmbH**, Hans-Pinsel-Str. 10A, 8013 Haar, München, Tel: 089-46140,
Telex: 05-22593 (HITEC D) **Hitachi Electronic Components (U.K.) Ltd.**, HITEC House, 221-225 Station Road, Harrow, Middlesex, HA1 2XL, Tel: 01-861 1414,
Telex: 926293 (HITEC G) **Hitachi Semiconductor (Hong Kong) Ltd.**, No. 706-707, 7th Floor, Wing on Plaza, Salisbury Road, Tsimshatsu, Kowloon, Tel: 3-7219218/9,
Telex: 40815 (HISAL HX) **Hitachi America, Ltd., San Jose Office**, 1800 Bering Drive, San Jose, Calif. 95112, Tel: (408) 292-6404, Telex: WU171581, TWX910 338 2103
(HITACHI SNJ)

Circle 116 on reader service card

Assembly Process Engineer

Swindon~England

Plessey Semiconductors, one of the fastest growing integrated circuit manufacturers in Europe, are based in Swindon, a town rapidly emerging as the axis for British high technology.

We now have an excellent career opportunity for an experienced engineer who will report to our Assembly Manager. The person appointed will be responsible for maintaining and improving assembly processes of consumer and Hi-Rel products using Bipolar, MOS and CMOS technologies.

Applicants, preferably with a degree in Engineering, must currently be working in this field and must possess at least 3 years' relevant experience.

A highly competitive salary will be offered plus other excellent benefits associated with a large and successful company. A generous relocation package will be available if appropriate.

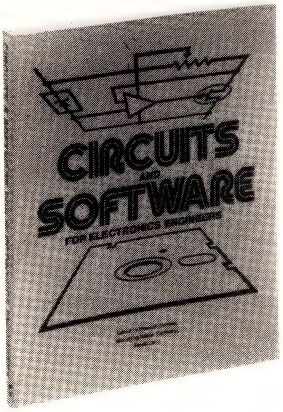
To apply either telephone Swindon + 44 793 36251 or write with cv to:-
Barbara Bailey, Plessey Semiconductors, Cheney Manor, Swindon, Wiltshire SN2 2QW, England.
Please quote reference EL/P/261.

PLESSEY

In a word, success

Circle 117 on reader service card

CIRCUITS AND SOFTWARE FOR ELECTRONICS ENGINEERS



Easy, reliable solutions to your design problems!

Covers a vast range of design problems, organized into 25 vital categories by function.

Contains hundreds of circuits and computer programs.

Design appropriate circuitry to meet the most challenging specifications.

Cut design time by adapting proven circuits and software to a wide range of applications.

Save money and increase productivity by avoiding costly design errors.

These creative, new ideas and approaches keep you on top of what's happening in the latest circuitry developments.

ORDER YOUR COPY TODAY! Send $19.95 to:

Electronics Week Books
McGraw-Hill Inc.
Priceton Road
Hightstown, N.J. 08520
(Tel.) 609/426-5070

or

McGraw-Hill Int'l. Pub. Co.
Attn: ECC
McGraw-Hill House
Maidenhead, Berkshire SL6 2QL
England

Ten-day money back guarantee. Allow 4 to 6 weeks for delivery.

opment, including expert systems, natural languages, intelligent robotics, vision systems, automatic programming, and theorem proving.

The standard 4404 is a desktop system built around a 10-MHz 68010 processor with no wait states. A hardware accelerator supports floating-point operations. The 1 megabyte of random-access memory provided can be doubled. Page-on-demand memory management provides a large, 8-megabyte virtual memory address space that permits users to develop complex programs without segmentation or overlays. The mass storage system consists of a 20-megabyte Winchester disk drive, a 5¼-in. floppy-disk drive, and an optional streaming-tape drive.

The 4404's monochrome bit-mapped graphics display is refreshed at a 60-Hz rate, noninterlaced. The 640-by-480-pixel display acts as a window into the 1,024-by-1,024-pixel display address space. A mouse comes with the system.

Optional programming languages—Lisp and Prolog—and networking capabilities will be available next spring.

Tektronix Inc., P.O. Box 500, Beaverton, Ore. 97077.
Phone (503) 644-0161 [Circle 399]

TERMINALS

Terminal mimics VT220 but adds features

The CIT-220+ monochrome alphanumeric terminal, the first in a line of DEC VT220/100-compatible terminals, has a separate video-display module less than 1 ft high in a 13-

by-16-in. footprint and a front-mounted on/off switch and power-on indicator. The 12-in.-diagonal glare-free screen with 25° tilt is available in standard white or optional P31 green and P22 amber phosphors.

Other features not found on DEC's VT220 include four additional setup screens, for a total of 11; a variable-speed smooth-scroll rate for various reading speeds; regional screen erasing; a multimode bidirectional auxiliary port enabling the CIT-220+ to alternate between two host systems; a selectable passive or active 20-mA current-loop interface; and use of all VT220 control sequences as well as additional control sequences.

The CIT-220+'s format is 24 lines by 80 or 132 characters; its matrix measures 7 by 10 characters. Both RS-232-C and 20-mA current-loop interfaces are standard, the maker says. Available now, the terminal sells for $1,295.

CIE Terminals, Inc., 2505 McCabe Way, Irvine, Calif. 92714.
Phone (714) 660-1421 [Circle 339]

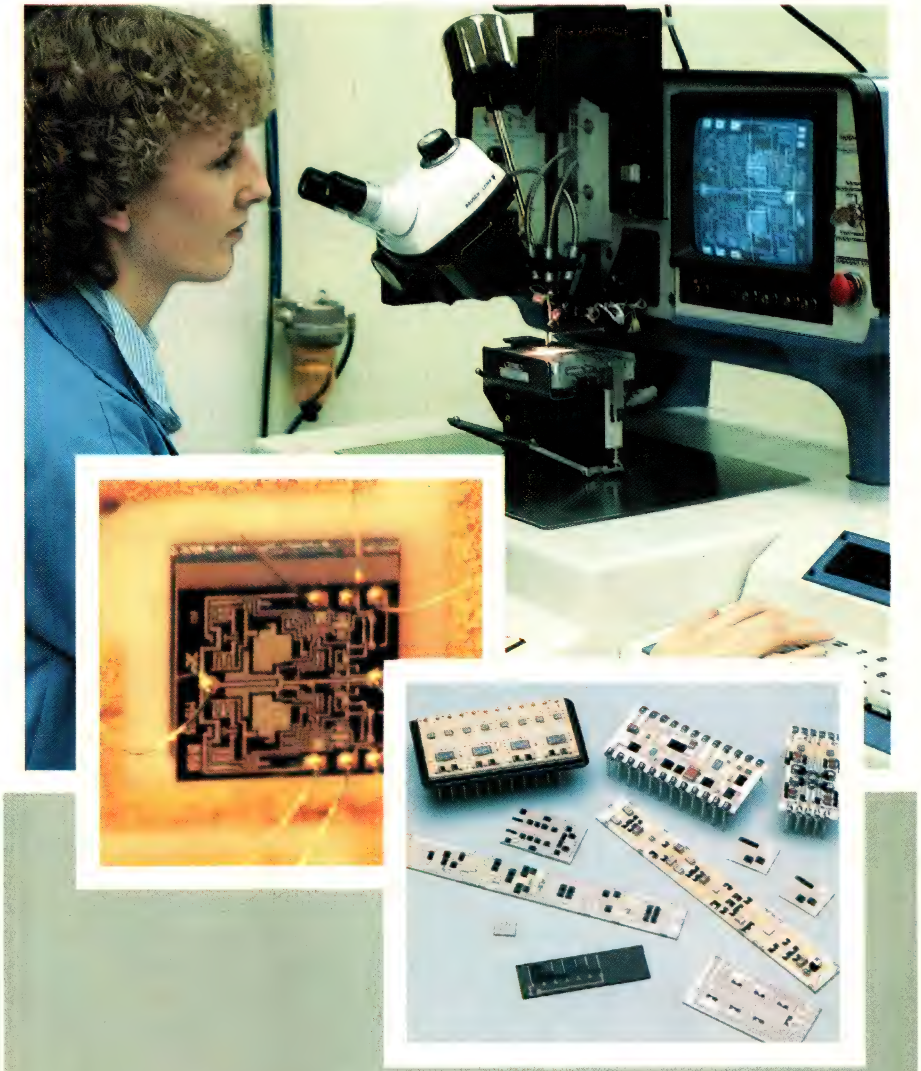
Composite color monitor works with home computers

Designed to be compatible with most home or personal computers including those from IBM, Apple, Atari, and Commodore, a composite color video monitor has a 260-by-300-pixel resolution and a dark-bulb cathode-ray tube for high-contrast displays for games and graphics. The Color 300 has separate chrominance and luminance video-signal input, suiting it to the Commodore 64 computer.

The monitor can display up to 40 columns by 25 lines of text. With its built-in speaker and audio amplifier, it can be used for computers with audio output but no sound capabilities. What's more, the Color 300 has a headphone jack designed into its cabinet, thereby suiting it for use in classrooms or where privacy is needed by the user.

Available now for immediate delivery, the Color 300 has front-mounted operator controls, including an on/off power switch with light-emitting-diode display, brightness, contrast, and volume. The manufacturer says

Your
CUSTOM HYBRID
Source



Put your hybrid circuit needs in the hands of an industry pioneer. HEI has been in the hybrid circuit manufacturing business for over 15 years, and offers the latest in processing capabilities and staff talent to meet your requirements.

HEI specializes in production of custom design-disclosed, high density active hybrid circuits for all kinds of electronic applications. Capabilities include automated ceramic sawing, computer-controlled laser trimming of circuits under load, automatic wire bonding and computerized circuit testing.

HEI offers two-week turn-around on quotes, and just seven weeks for prototypes. Call the Hybrid Hotline—612-443-2500 for clear answers to your custom hybrid circuit manufacturing questions.

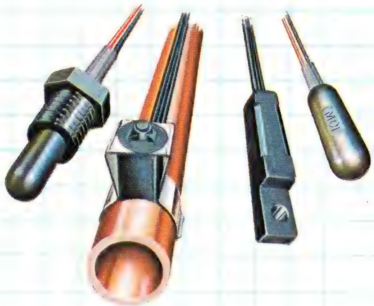
HEI inc.
Victoria, MN 55386 • 612-443-2500

Circle 89 on reader service card

New TUFF·SENSORS™— temperature probes hermetically sealed against harsh environments.

Midwest Components now manufactures a complete line of molded thermoplastic probes, which can use either an NTC or PTC thermistor (for a resistance vs. temperature change) or a temperature switch (for single set-point sensing). Catalog shows:

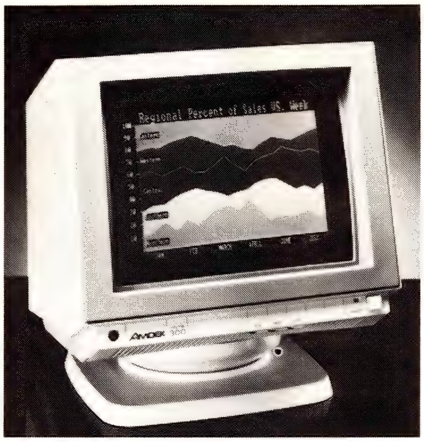
- Full line of stock shapes.
- Specifications for designing your own Tuff-Sensor™.



Write or call today for your FREE Tuff-Sensor™ Catalog.

MIDWEST
COMPONENTS
INC.

P.O. Box 787 Muskegon, MI 49443
616/777-2602 • TWX 510-394-4130



the monitor lists for $350 and is also available with an optional tilt/swivel base stand.

Amdek Corp., 2201 Lively Blvd., Elk Grove Village, Ill. 60007.

ROBOTICS

Robot can do dangerous assembly work

Designed to automate simple tasks, the Alpha II robot system can perform dangerous and repetitive light-assembly tasks in the electronics and pharmaceutical industries. Its manufacturer says the system is less expensive than conventional light assembly robots that perform intricate work beyond the range of human precision.

The Alpha II's tendon technology consists of a stainless-steel cable system similiar to that used in high-speed computer printers. The stepper motors that move the robot arm, which has a reach of 18 in., are located at the unit's base instead of at the joints; cables run from the motors to the joints to drive the arm's movement.

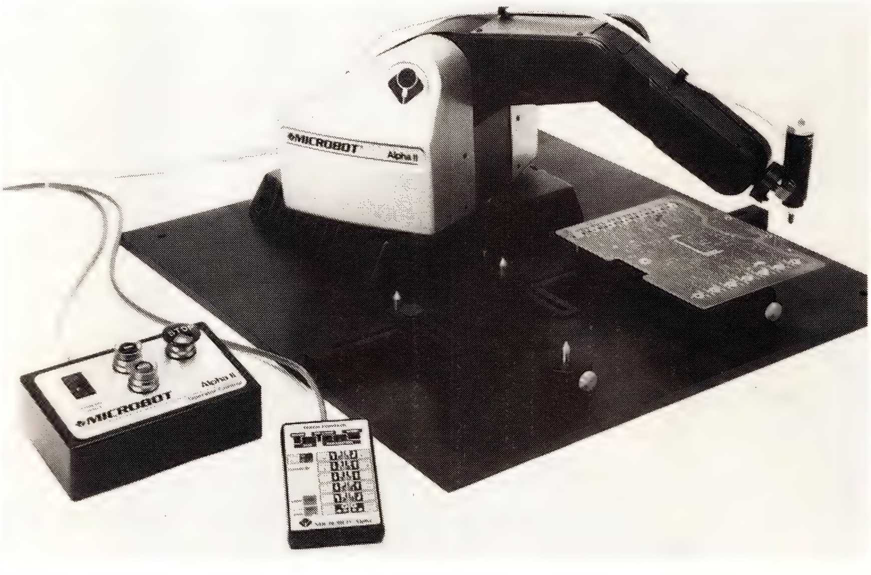
Its 8-bit 6502A microprocessor has 8-K bytes of erasable programmable read-only memory, 4-K bytes of electrically erasable PROM, and 1-K byte of random-access memory. The robot's work cell interface, containing 18 input/output channels for optically isolated interfaces at factory voltage levels, connects the unit to sensors, actuators, and other peripherals in the work cell.

The system control stores up to 227 program steps in memory and can be programmed through a hand-held control containing 14 multifunction keys. Alpha II can also be controlled from a computer over an RS-232-C link.

An accompanying turnkey system, the Robotic Dispensing System, performs a variety of fluid dispensing applications such as solder masking for printed-circuit boards. The system includes a 10-oz pressurized reservoir with an antidrip dispensing valve, a compressed air-filter regulator, solenoid valve, and hoses.

The Alpha II is priced at $13,425 and the Robotic Dispensing System at $19,350. Both are available now.

Microbot Inc., 453-H Ravendale Dr., Mountain View, Calif. 94043.
Phone (415) 968-8911 [Circle 342]

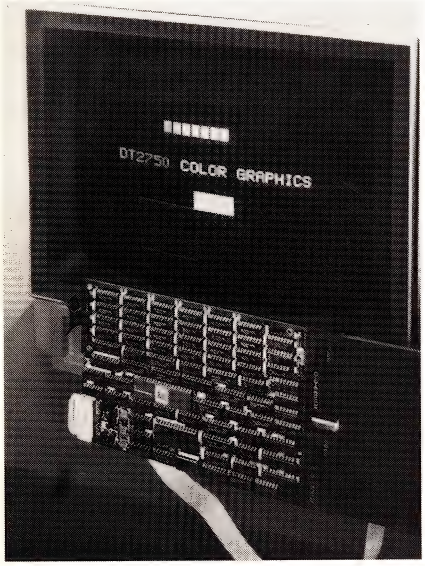


COMPUTER GRAPHICS

Plug-in card lets Q-bus processor create graphics

With the DT2750 full-color raster graphics subsystem, any Q-bus Bus processor can generate and display both graphics and alphanumerics on a monochrome or standard color monitor. Applications for units with the subsystem include process monitoring and control, medical electronics, business graphics, and visual network control.

The graphics board contains a 192-K-byte graphics random-access memory organized as two independent display buffers with 512 by 512 by 3 pixels each. The frame size may be reconfigured by means of jumpers to 512 by 256 by 3 pixels. The depth, which is 3 bits, permits display of eight colors simultaneously, selected by a lookup table from a palette of 512 colors.



The DT2750 includes two independent processors: a vector generator and a character generator. This allows for fast screen-writing speeds with little overhead to the host computer. The unit's two image buffers and fast drawing speed permit generation of fast picture sequences and film effects. Available now with two software support packages, the DT2750 graphics subsystem is priced

Our inductive components make your power supplies more efficient!

Switched power supplies have significantly lower weight and volume, compared to standard units working at line frequency. Also greatly enhanced is efficiency due to lower total losses.

Select from a broad product range
Since the beginning of the new switching technique, we have developed a range of transformers and chokes to fit the need of the design engineer of power supplies. He can select not only components with appropriate electrical data but also the desired mechanical specifications e.g. connecting and mounting facilities.

Each type you need
As standard units available are (usually from stock)

- Power transformers (typical working frequency 20 kHz)
- Storage chokes with linear or non-linear characteristics
- Current and control transformers
- PCB-mounting line transformers for auxiliary supply voltages.

If standard units are not sufficient, we can tailor the device you need — as we have done for example for high frequency (50 kHz and above) power transformers.

VAC
VACUUMSCHMELZE
West-Germany
VACUUMSCHMELZE · HANAU
Grüner Weg 37, D-6450 Hanau 1 · Phone: (0 61 81) 362-1 · Tx. 4 184 863
US-Office: VACUUMSCHMELZE c/o Siemens Components, Inc.
186 Wood Av. South, Iselin N.J. 08830 · Phone: (021) 494 3530 · Tx. WU 844 491

M-4e

Circle 91 on reader service card

1984 World Markets Forecast Data Book

Now available, the 26th annual market forecast gives an analytical profile of the current and future demands of the electronics market. It covers 845 electronics products in the categories of semiconductors, components, communications equipment, data-processing and office equipment, industrial and consumer electronics and test and measurement equipment.

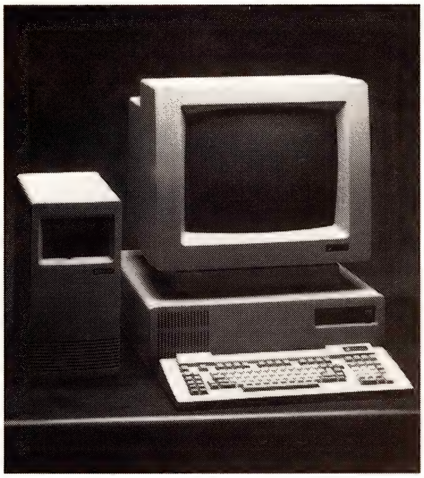
Other statistics reported include: compound growth rates, worldwide industry summary, country-by-country estimates for Western Europe, and more!

Order your copy today!
Send $175 to: **Electronics Week Books**
McGraw-Hill Inc.
Princeton Road
Hightstown, N.J. 08520
(Tel.) 609/426-5070
Payment must accompany all orders. USA residents please include sales tax.

at $1,995. The software packages sell for $395 and $595.

Data Translation, 100 Locke Dr., Marlboro, Mass. 01752.
Phone (617) 481-3700 [Circle 343]

32032-based work stations sell to OEMs for $18,300



An eight-model family of high-resolution 32-bit graphics work stations with Unix-derived software and Ethernet interfaces will enter the market this fall. Prices will range from $25,900 to $40,900.

The work stations, called Shared Vision Systems, use 60-Hz noninterlaced screens and three National Semiconductor Corp. 32000-family chips: the 32032 microprocessor, the 32082 demand-paged memory-management unit, and the 32081 floating-point processor. The work stations will also include from 1 to 8 megabytes of error-correcting-code random-access memory, a dedicated graphics processor, one 85-megabyte Winchester disk drive, one 45-megabyte streaming-tape drive, and Multibus interface slots.

Three monitors will be offered for the work stations: 1,024-by-800-pixel, 15-in. monochrome; 1,024-by-1,280-pixel, 19-in. monochrome; and 512-by-640 pixel, 19-in. color. The manufacturer says that the color display has 4 or 8 bits per pixel with a palette of 16 million colors.

Software offerings include the Mosaix operating system, based on Unix 4.1 BSD with features found in 4.2 BSD and System V versions of AT&T Bell Laboratories' popular operating system. Programming languages available include C, Fortran-77, and ANSI Pascal. The system also provides a high-level language debugger, assembler and debugger, graphics-image management system, screen manager, VT-100 and Tektronix 4014 terminal emulation, file-transfer capability, and Fusion network software.

Volume prices for original-equipment manufacturers start at $18,300. Mosaic says the products will be available for general delivery starting in October.

Mosaic Technologies Inc., 47 Manning Rd., Billerica, Mass. 01821.
Phone (617) 667-2383 [Circle 396]

COMPONENTS

Switches can see objects moving at 450 ft/min

A line of proximity switches operates in a manner similar to mechanical-limit switches, but performs additional functions. They provide an electrical output appropriate for applications such as construction equipment, conveyers, and trucks.

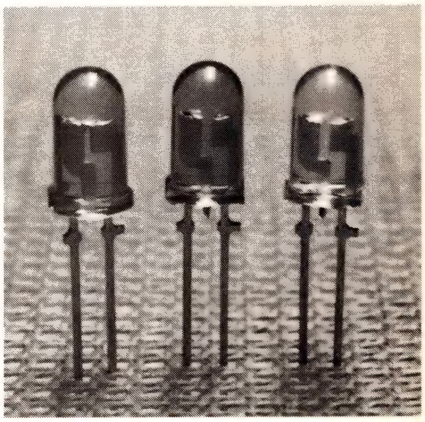
Depending on the operating principle, the switches are either inductive, capacitive, or ultrasonic. The inductive switches are actuated by metals only, whereas the capacitive models can be actuated by nearly all materials, whether in solid, liquid, or powder form.

The ultrasonic switch is also actuated by most materials and provides a large selectable range. The proximity switches can detect objects approaching at speeds of up to 450 ft/min and operate at up to 12 million cycles/h. They boast a repeatable accuracy to within 0.02 mm and are insensitive to vibration, hostile environments, and climate.

Available from stock, inductive and capacitive switches range in price from $36 to $156, while the ultrasonic switch sells for $280.

Siemens-Allis Inc., P.O. Box 89000, Atlanta, Ga. 30356.
Phone (404) 393-8200 [Circle 355]

Dual-chip LED lamp suits backlighting



A light-emitting diode designed for backlighting features two chips in series mounted in a plastic molded lens. The lamps come in red, green, yellow, and orange and are suitable for pulse operation.

A low drive current gives a high luminous intensity with a wide radiation pattern. Priced at 34¢ each in lots of 1,000, the lamps can be delivered within 90 days.

A.N.D., 770 Airport Blvd., Burlingame, Calif. 94010.
Phone (415) 347-9916 [Circle 357]

Surface-mountable inductors can be handled by robots

A series of inductors features surfaces capable of vacuum pickup and handling by robotized pick-and-place machines. The SMI-200 series is available in bulk packs or on tape and reels.

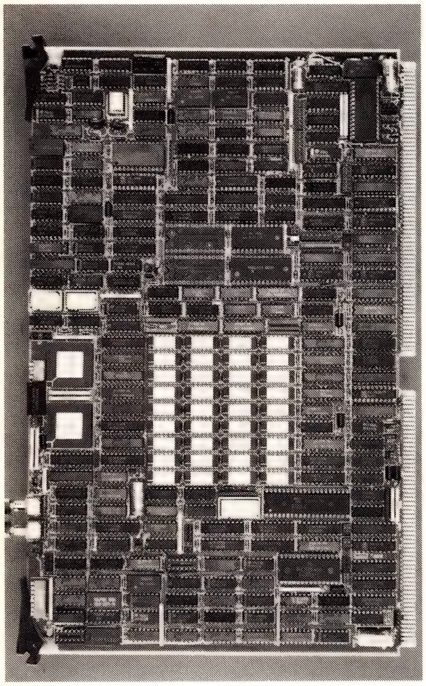
Available in two sizes, 0.215 and 0.400 in.^{2}, the inductors have a maximum height of 0.250 in. and accommodate a range of inductor values from a few to several hundred microhenries. The inductor, which withstands solder reflow and detergent washes, operates in temperatures from –40° to +70°C.

Available now, the inductors are priced at under $1 each in quantities of 25,000.

West-Cap Arizona, 2201 E. Elvira Rd., Tucson, Ariz. 85706.
Phone (818) 361-1176 [Circle 356]

MICROSYSTEMS

VERSAmodules target CAD and robotics



A single-board microcomputer, one of a series of products added to the VERSAmodule line, is intended for firms designing systems for such applications as robotics, computer-aided design, and telecommunications. Designed to function in VERSAbus systems ranging from a single module to complex multiprocessor configurations, the VM03-4 uses an MC68010 processor operating at a fixed speed of 10 MHz.

The VM03-4 features the MC68451 memory-management unit and 1-K byte of on-board dynamic random-access memory with parity checking. Available operating systems include Unix release 2.2 and VERSAdos release 4.3.

The 68000-based VM22 one-board disk controller with on-board RAM and read-only memory provides an intelligent interface between hard disk, floppy disk, and the VERSAbus. Data-transfer speeds of up to 3 Mb/s are maintained by direct memory access. The model VM12-2 is a 4-megabyte dynamic-RAM module

Now, that's a high density photomultiplier power supply!

This is the smallest of DEL's compact PMS Series of rugged DC to DC proportional converter power supplies for photomultipliers and other high voltage applications.

- **Over 21 models from 300-1500V to 3KV-10KV**
- **Output isolated from input**
- **Output proportional to input**
- **Output momentary short circuit protected**
- **All models offer high density compact profiles**

All PMS models are isolated for full output voltage to case. 0°-60°C operating temperatures with a coefficient of .02%/C typical. Many units have reversible polarity with any combination of input/output polarity vs. ground.

DEL

Write or phone today for full details and prices on DEL's PMS Series...

DEL ELECTRONICS CORP.
250 East Sandford Boulevard
Mount Vernon, NY 10550
Phone: 914/699-2000 TWX: 710/562-0130

Circle 93 on reader service card

October 5-11, 1984
CETDC EXHIBITION COMPLEX
Taipei Sungshan Airport, Taiwan, R.O.C.

TAIWAN ELECTRONICS SHOW

Taiwan, emerging as a little giant of the electronics world, will present at the annual Show an extensive new line of consumer electronic goods, industrial and household products, computer and peripherals, telecommunication equipment, etc. State-of-the-art technology is incorporated in many of the exhibits. Among other surprises you will find here are: competitive pricing, ingenious design and attentive service.

Organizer:
china external trade development council
201 Tun Hwa North Road, Taipei, 105, Taiwan, R.O.C.
Telex: 28094 TPEWTC Tel.: 715-1551

Taiwan Electric Appliance Manufacturers' Association
7th Fl., 315 Sung Chiang Road, Taipei 105, Taiwan, R.O.C.
Telex: 22389 TEEIA

Circle 121 on reader service card

used for high-speed storage in VERSAbus systems.

The VM03-4 microcomputer is priced at $6,050, the model VM22 at $2,690, and the VM12-2 at $13,400. The three products will be available this quarter.

Motorola Semiconductor Products Inc., P.O. Box 20912, Phoenix, Ariz. 85036.
Phone (602) 438-3506 [Circle 359]

Front-end processor ups power of Q-bus systems

A communications processor that uses Digital Equipment Corp.'s J11 chip provides coprocessing on the Q bus and boosts the power of smaller systems. The front-end processor is quite suitable for multiprocessing applications, and it also eliminates the need for external communications systems based on central processing units, for line switches, and for protocol converters.

The MLSI-JFEP11 has an on-board dual-ported memory providing completed messages for the processor, two 1-megabaud serial ports, and an external parallel bus for unlimited input/output expansion. It has been programmed in the PDP-11 instruction set. Besides multiprocessing, it can be used for such applications as dynamic communication line resource allocation, data compression/decompression, message processing, routing, and protocol conversion.

Available within 60 days, the MLSI-JFEP11 is priced at $4,950.

MDB Systems Inc., 1995 N. Batavia St., P.O Box 5508, Orange, Calif. 92267.
Phone (714) 998-6900 [Circle 360]

128-K memory module is compatible with EXORbus

A 128-K-byte module combining erasable programmable read-only memory and static random-access memory is compatible with all microprocessors in the M6800/M6809 line. The model 9632 is designed to comply with the timing and signal-level requirements of a buffered M6800 bus.

Compatible with the Motorola EXORbus, the module provides 131,072 bytes of storage and allows users to intermix both RAM and EPROM—without having to modify the socket—in increments of 8-K bytes. Model 9632 is configured as one large 128-K-byte memory block containing 16 switch-selectable 8-K-byte blocks. It is available in a configuration populated with all components except memory devices.

The model 9632 costs $295; delivery is from stock.

Creative Microsystems, 3822 Cerritos Ave., Los Alamitos, Calif. 90720. Phone (213) 493-2482 [Circle 361]

CAD

Terminal does adjunct functions to offload work

With a display-only system, graphics information can be transferred from one of its manufacturer's computer-aided engineering, design, or manufacturing systems to an inexpensive terminal that provides local display, zooming, panning, and color-change capabilities.

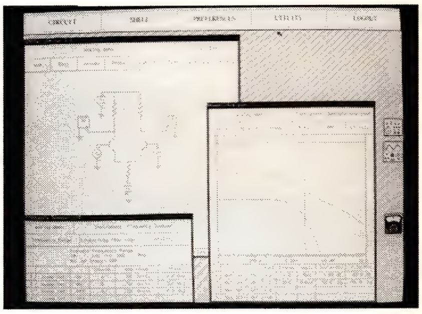
The system features a 13-in. color screen with a resolution of 640 by 480 pixels. The local zooming and panning resolution is enhanced by an addressable display matrix of 4,096 by 4,096 pixels.

Dots, as the system is called, is intended for firms where electronic drawings are needed for security reasons and for those desiring to integrate their Calma CAE/CAD/CAM systems with other departments. If required, a local hard copy can be produced by a graphics plotter.

The price of the Dots terminal and software, available now, is $14,000.

Calma Co., 2901 Tasman Dr., Santa Clara, Calif. 95050.
Phone (408) 748-9600 [Circle 362]

Software lets system design analog circuits



Analog designers have been largely left out of the great rush to automate circuit design—but help is on the way thanks to software developed for what may be the first engineering work station dedicated to analog circuit design. Running on Sun Microsystems hardware, the Analog Workbench allows designers to construct circuits from a component library and then test the circuits with simulated function generators, oscilloscopes, and other test equipment.

Digital-design work stations trace thousands of logical elements but require only a logic analyzer for testing. In contrast, an analog design may have only 30 to 40 elements, but each requires detailed characterization and a variety of test gear.

Like digital design work stations, the Analog system has a mouse with which the user can manipulate circuit elements. Results of a modification to a circuit, by changing the value of a component, for example, will be propagated throughout the design and the effects displayed in a few seconds. When the circuit is completed, probes can be attached to connect a variety of simulated test instruments, with results shown in a window on the screen.

Three test setups are available—time and frequency domains and a dc setup. Software provided with the system includes circuit-element libraries, a graphics editor, the simulation programs, and a C compiler. A basic system, including a Sun model 2/120 with a 50-megabyte Winchester disk drive and a 900-by-1,152-pixel display, costs about $75,000. The manufacturer expects to be shipping by October.

Analog Design Tools Inc., 800 Menlo Ave., Suite 217, Menlo Park, Calif. 94025.
Phone (415) 328-0780 [Circle 397]

IC EQUIPMENT

Stripper can handle 6-in. wafers

A dry photoresist stripper, the Megastrip 6, handles wafers measuring up to 6-in. in diameter. The stripper's features include automatic pressure control with an isolated capacitance nanometer, mass flow control, stainless-steel plumbing, and microprocessor control.

Megastrip 6 processes 50 6-in. wafers, 75 5-in. wafers, and 100 4- or 3-in. wafers per load. The unit even removes high-current ion-implanted positive photoresists.

Priced at $35,000, it is available now, with delivery taking about 10 weeks.

Drytek Inc., 16 Jonspin Rd., Wilmington, Mass. 01887.
Phone (617) 657-3933 [Circle 363]

Unit magnifies wafers, displays defects on monitor

A new edge-profile comparator detects deficiencies in the edge roundness of unbroken semiconductor wafers. The model 102 magnifies the edges of wafers 100 times and displays the image on a 12-in. monitor.

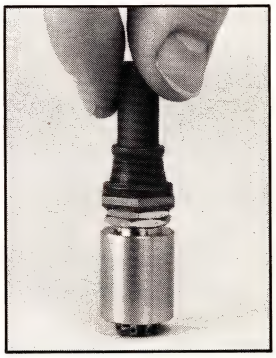
The model 102 continuously displays the contour of an unbroken wafer slice as it rotates 360° in the wafer holder. It loads the wafers from the side into a rubber-coated turntable. The comparator accepts a number of standard wafer sizes, from 2 to 8 in. in diameter.

Available now, the main unit sells for $7,345, according to the manu-

Proportional Joysticks Small Size Big Performance

They're only a little over an inch long and weigh under an ounce, but their performance is king-size.

Operation is easy and natural, promoting higher speed and accuracy in positioning and tracking tasks. Resolution is infinite, with continuous output and no dead zone. Rugged construction allows flawless operation even in severe environments. And mean time between failures is 200,000 hours, with a minimum of 10,000,000 cycles.



Small wonder these joysticks have been used so successfully in computer graphics, visual displays, fire control systems, hoists, vehicle control and robots, among other applications. Chances are they could be useful to you, too.

Want to find out? Just call or write us for more information.

MS Measurement Systems, Inc.
121 Water Street, Norwalk, CT 06854 203-838-5561

Circle 95 on reader service card

SAVE BIG ON COMPUTER PRODUCTS

MODEMS

HAYES	
Smartmodem 300	200
Smartmodem 1200	489
Smartmodem 1200B	425
Micromodem II E	240
Smartcom II Software (for IBM PC)	90
Cables to Hayes Modems	CALL
NOVATION	
SmartCat Plus (NEW)	CALL
J. Cat 300B direct	99
103 SmartCat 300B Smart	159
103/212 Smart 300/1200 B	379
AppleCat II 300 baud for Apple	200
212 AppleCat 300/1200B for Apple	390
Access 1-2-3 1200B for IBM	379

MONITORS

SUPER SPECIAL!!

COMREX	
12" Green Hi. Res.	75
AMDEK	
V300G 12" green	122
V300A 12" amber	145
V310A 12" amber (for IBM)	160
Color I+ 13" composite	280
Color II+ 13" RGB	425
Color IV 13" RGB analog	740
Monitor Cables	
CB 5690 Apple II to Monitor	7
CB 5691 IBM to RGB	19
CB 5692 for TI-99/4A or Commodore	15

QUADRAM

MICROFAZER	
QRMP-8 Par/Par	135
QRMSP-8 Ser/Par	145
QRMMSS-8 Ser/Ser	145
QRMPS-8 Par/Ser	145
QUADBOARD (for IBM PC)	
QR 5310 (no mem. installed)	210
QR 5364 64K (mem. installed)	270
QR 4064 64K (mem. installed)	270
QR 8201 Quadcolor-1	200
QR 8202 Quadcolor-2 (upgrade kit)	200
QUADLINK	
QR 3000 for IBM	475
QR 3010 for Compaq	475
QR 3020 for Columbia	475

AST

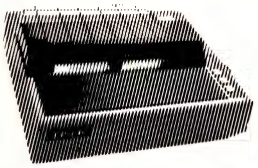
Six Pak Plus	270
Mega Plus II	270
1/0 Plus II	112

SAVE 31%-43%

OFF MFR. SUGG. RETAIL PRICES ON

PRINTERS

EPSON • OKIDATA • DIABLO
SCM • DELTA • GEMINI • TTX
RADIX • COMPUTE-MATE
MANNESMANN TALLY



CALL FOR PRICES

wabash maxell Dysan

DISKETTES

10 — 5¼" Floppy Diskettes

	SS /SD	SS / DD	DS / DD
Wabash	$13.00	$16.00	$17.50
Maxell	NA	20.00	26.00
Dysan	NA	23.00	30.00
10 — 8" floppy diskettes			
Dysan	NA	32.00	37.00

CALL FOR QUANTITY PRICING ON 10 OR MORE BOXES OF DISKETTES

HUGE DISCOUNTS all
RIBBONS • DUST COVERS
PAPER • POST CARDS • LABELS
for almost every make and model

HEWLETT-PACKARD

CALCULATORS

HP-11C	56	HP-15C	90
HP-12C	90	HP-16C	90
HP-41C	145	HP-41CX	245
HP-41CV	168	HP-97	560

all software & accessories too

PORTABLE COMPUTERS

HP-71B	399	HP-75D	799

series 70 software & peripherals discounted too

HP-2225B ThinkJet Printer (HPIL)	375

NEW

PERSONAL COMPUTATION DEALER

SHARP CALCULATORS

EL 5100	43
EL 5500 T	70
EL 512 T	28

SHARP HAND HELD COMPUTERS

pc 1250A	80
pc 1260	CALL
pc 1261	CALL
pc 1500A	160

PRINTERS DISCOUNTED TOO

CABLES — INTERFACES

accessories for Computer Printers

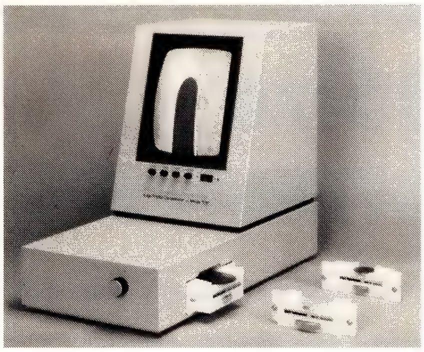
GRAPPLER PLUS	105
16K BUFFERED GRAPPLER	165
Apple Dumpling GX	65
Cardco G	65
CB5609 10 ft. Par. Cable for IBM	25
CB5622 10 ft. 36x36 Parallel	32
CB5629 10 ft. 25x25 RS-232	25
CB5618 6 ft. TI-99/4A parallel cable	25
CB5620 6 ft. par. TRS80 mod. I-III-IV	22
ALL OTHER CABLES	CALL

CALL TOLL FREE 800-621-1269 EXCEPT Illinois, Alaska, Hawaii

Corp. Accts. Invited. Min. Ord. $15.00. Mastercard or Visa by mail or phone. Mail Cashier's Check, Mon. Ord., Pers. Check (2 wks. to clr.) Add $4.00 1st item. (**AK, HI, P.R., Canada add $10.00 first item**) $1.00 ea. add'l shpg. & handl. Shipments to IL address add 7% tax. Prices subj. to change. **WRITE for free catalog. RETURN POLICY: Defectives Only: Most products replaced within 30 days of purchase with identical merchandise only. Computer and large peripherals replaced only when defective on arrival (within 3 work days of delivery). Other problems covered by mfr. warranty. ALL ELEK-TEK MERCHANDISE IS BRAND NEW, FIRST QUALITY AND COMPLETE.**

ELEK-TEK, inc. 6557 N. Lincoln Ave., Chicago, IL 60645
(312) 631 7800 (312) 677 7660

Circle 96 on reader service card



facturer. The wafer holders range in price from $420 to $795.

H&L Instruments, 1 Edwards Ct., Suite 205, Burlingame, Calif. 94010. Phone (415) 342-7850 [Circle 364]

Step-and-repeat handler works with 8-by-8-in. boards

A microprocessor-controlled step-and-repeat handler, designed for use with the company's CLS-37W wide-area laser trimming system, can handle large ceramic circuits and printed-circuit boards up to 8 by 8 in. in size, with a position repeatability to within 0.0001 in.

The step-and-repeat handler's high speed and accuracy are due to a linear reluctance positioner that eliminates the need to convert rotary motion to linear motion. The handler rides on an almost frictionless stage using air bearings and uses the model CLS-37W's central computer to program its movement. Direct linear motion occurs as a result of microprocessor-controlled sequencing of the coil drive, the company says.

The operator sets the step-and-repeat pattern by answering questions from a menu presented on the system's terminal. Then the program determines the best minimum and maximum path movement.

The start and end positions of the trim pattern are established by the operator during the handler's setup mode. The company says a self-diagnostic program automatically checks the equipment.

Prices of the unit, which can be delivered three months after receipt of order, start at $60,000.

Chicago Laser Systems Inc., 4034 N. Nashville Ave., Chicago, Ill. 60634.
Phone (312) 282-2710 [Circle 365]

INDUSTRIAL CONTROLS

IBM PC-based unit tracks employee data

Originally developed for IBM Corp.'s Series/1 computers, the Tass time and attendance system can now be had on an IBM Personal Computer. The time and attendance system, which comes with bar-code readers, automatically records actual hours worked, calculates overtime and fringe benefits, and provides payroll data transmitted to a variety of automated payroll systems.

Using the same card that clears people for entrance to restricted areas, employees clock in and out by inserting the badge into a card reader near their work areas. The system automatically notes the time—to within tenths of a min—date, employee information, and reader location as each badge is read. From this information, it builds an electronic time-card file.

An electronic time-card report is produced, by department, showing for each employee the hours worked by day and for pay period to date. Some special reports that can be generated include early arrival, late departure, overtime, daily departure, and weekly exceptions.

The system, including the IBM PC and four card readers but not installation, sells for between $10,000 and $13,000.

Computer Application Systems Inc., 1340 Neptune Dr., Boynton Beach, Fla., 33435.
Phone (305) 736-3500 [Circle 400]

Multibus boards build factory automation systems

A series of Multibus-compatible numerical-control boards are intended for manufacturers of factory automation systems and cost up to 30% less than previous models, according to the maker. The boards incorporate two of the firm's proprietary complementary-MOS large-scale integrated circuits that can be used to control either servo or stepper motors for a wide range of applications, such as machine tooling, robotics, and table movement.

Models include the NCB-102-2B Master Board for two-axis control, and its slave, the NCB-102-3B, which allows control of one or two additional axes. Configurations for controlling four and six axes are made possible with the NCB-102-5 Master Board and the NCB-102-6 (four axes) or NCB-102-7 (six axes) expansion modules.

Both linear and circular interpolations can be programmed. An on-board 4-MHz Z80A processor allows high-speed communication between the host central processing unit and the tool or robot being controlled. Control functions that are provided include automatic acceleration, emergency stopping, and encoder-pulse multiplication.

Installation and application information are provided with the board, which is available immediately. In sample quantities, the NCB-102-2B is priced at $2,150 and the NCB-102-3B at $3,160.

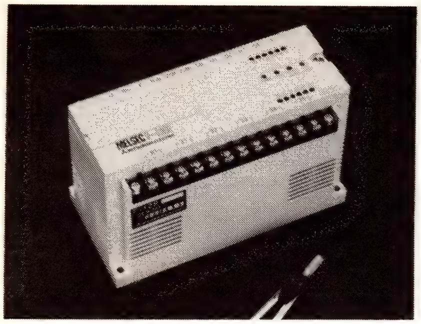
Toko America Inc., 5520 W. Touhy Ave., Skokie, Ill. 60077.
Phone (312) 677-3640 [Circle 373]

Programmable controller has up to 32 I/O points

A programmable controller suitable for governing motors, switches, and similar devices in industrial environments where space is tight, retains the memory and execution capacities of the company's larger F-20 and F-40 units but is considerably smaller. The 2.8-lb model F-12R is compatible with all F series peripherals and extension units available for the company's controllers.

The model F-12R runs on 110/120-V ac at 50/60 Hz, and its battery-backed random-access memory can contain 320 program steps. Programs, written in relay ladder language used for most programmable controllers, execute at speeds of up to 100 μs/step.

With 12 input/output points built in, the model F-12R is expandable to as many as 32 points through the use of extension units. The 12 points



consist of six inputs that accept signals as high as 20 V dc at 7 mA and six outputs that interface with external devices by relays that handle up to 2 A. One of several hardware features enhancing the controller's operation, eight timer outputs are programmable for durations ranging from 0.1 to 99 s. The model F-12-R sells for less than $200 in large quantities and is available from stock.

Mitsubishi Electric, Industrial Products Division, 3030 E. Victoria, Rancho Dominguez, Calif. 90221.
Phone (800) 421-1132 [Circle 374]

COMPILERS

Pascal compilers build code for 68000s, 8086s

Pascal compilers for the 68000 and 8086 processors have been added to a line of C and Pascal off-the-shelf compilers. In addition to implementing the Pascal standard, the compilers have a preprocessing capability that supports conditional compilation, an include facility, and an ability to define macroinstructions with or without arguments.

The two models are compatible with InterC compiler-and-assembler output to allow the mixing of high-level languages and assembler routines in a load module. InterPas/68000 and InterPas/8086—which are currently hosted on VAX computers running under VMS or Unix, and the Apollo computer—are source-compatible with native host compilers.

Complete compiler systems, including assemblers and utilities, sell for $8,000 and are available for im-

MODULAR PROBES FOR SALE

For All Oscilloscopes
To 300MHz
X1 to X100
Attenuation

Pictured
Accessories
Included

INSTANT REPAIR
Probe tip, Head, BNC and Cable all screw into place easily and quickly.

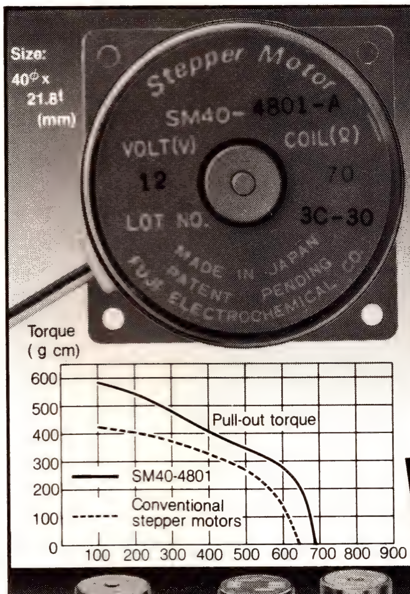
TEST PROBES, INC. TPI
Your Probe Specialists

COMPARE PRICE — COMPARE PERFORMANCE

Model	Attenuation	Bandwidth	Price
M12SW	X1-X10 Switchable	X1-10MHz X10-250MHz	$69.00
M12X10	X10	250MHz	59.00
M12X10AP	X10 with Readout	250MHz	65.00
M15X100	X100	250MHz	89.00
M15X10HF	X10	300MHz	75.00
M12X1	X1	30MHz	36.00

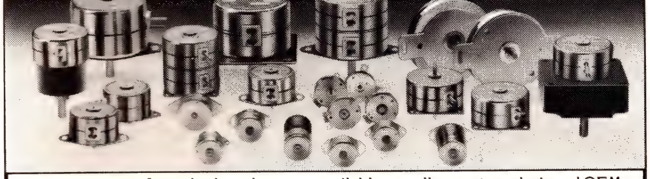
Coline U.S. Sales & Stocking Source P.C. Box 2113, La Jolla, CA 92038 (619) 459-4197

Circle 97 on reader service card



30% MORE TORQUE

STEPPER MOTOR SM40-4801



A wide variety of standard products are available as well as custom-designed OEM products. For further details, please contact:

Fuji Electrochemical Co.,Ltd.

● **Head Office** 5-36-11, Shinbashi, Minato-ku, Tokyo 105, Japan (Hamagomu Bldg.) Phone:(03)434-1271 Telex:242-2174(FNOVEL J) ● **New York Office** Phone:(201) 585-8543/8544 Telex:133183(FECNY) ● **Los Angeles Office** Phone: (213)323-1134 Telex:696128(FUJINOVEL GDNA) ● **Düsseldorf Office** Phone: 211-3689-253/257 Telex:8587994(KGDD) ● **Taipei Office** Phone:(02)914-5349 Telex:31563(FUCHITON) ● **Singapore Office** Phone:469-5806 Telex:27237(SINFEC)

Circle 118 on reader service card

mediate delivery.

Intermetrics Inc., Software Products Division, 733 Concord Ave., Cambridge, Mass. 02138.
Phone (617) 661-0072 [Circle 366]

Fortran 77 compiler is intended for HP 200 series

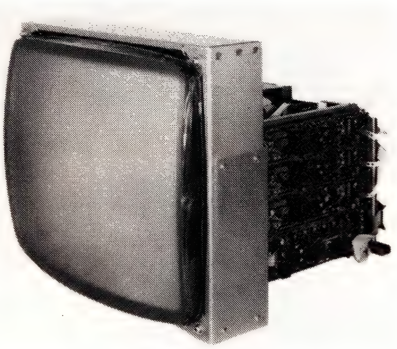
Taking full advantage of the processing power, speed, memory, and graphics of the Hewlett-Packard 200 desktop computers, the IEM Fortran 77 compiler comes with a security module and documentation. Available on either 8-, 5¼-, or 3½-in. flexible disks, the compiler is priced at $1,200 and can be delivered within three weeks.

The IEM Fortran 77 Demo, which lets the user learn to use the software, includes instructions, several sample programs, and a version of the compiler able to work on programs of up to 80 lines. Available in two weeks, it sells for $25.

International Electronic Machinery Inc., P.O. Box 1818, Fort Collins, Colo. 80522.
Phone (303) 226-6672 [Circle 367]

DISPLAYS

Color monitor's pixel resolution is 1,280 by 1,024



Intended for computer graphics, a 60-Hz noninterlaced red-green-blue monitor has a 1,280-by-1,024-pixel resolution and a 100-MHz video bandwidth. The circuit design of the DM-2050 ensures stable images, the company claims.

The lightweight monitor has a compact chassis using a modular circuit-board construction to simplify maintenance, and does not require cooling blowers. An in-line-gun cathode ray tube with a 0.31-mm trio-dot pitch and a black-matrix screen does not need convergence circuitry. Precise geometry, superior linearity, and color stability assure accurate imaging, according to the company.

Because the DM-2050's specifications can be altered, pricing varies.

Ikegami Electronics Inc., 37 Brook Ave., Maywood, N.J. 07607. Phone (201) 368-9171 [Circle 368]

Black-matrix monitor measures 40 in. diagonally

A black-matrix cathode ray tube monitor, designated the T101-01, measures 40 in. diagonally and boasts an aspect ratio of 5:3. It is intended for such applications as high-resolution data and TV-picture displays as well as computer-aided design and industrial uses.

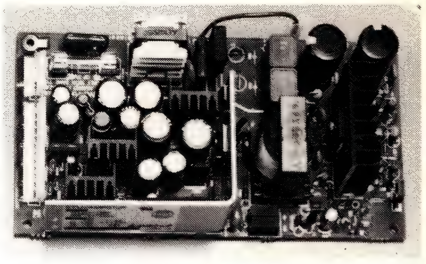
The monitor has a trio-dot pitch of 0.46 mm, and a resolution of 1,800 by 1,400 dots. These specifications are credited to such technologies as a high-performance high-bi-potential electron gun and an impregnated cathode for high beam current. The pricing and delivery schedule of the T101-01 have not yet been established.

Panasonic Industrial Co., 1 Panasonic Way, Secaucus, N.J. 07094. Phone (201) 348-7183 [Circle 369]

POWER SUPPLIES

Switchers have multiple outputs, can deliver 50 W

A line of switching power supplies, intended for computers and peripherals, has multiple outputs and can deliver a total output of up to 50 W.



The open-frame printed-circuit-board switchers offer high-frequency operation for improved efficiency and two jumper-selectable input-voltage ranges—from 85 to 132 V ac or 170 to 264 V ac, both at 47 to 440 Hz.

The switchers provide up to four outputs that are typically 5 V dc at 1 to 6 A, 12 V dc at 0.5 to 2.5 A, −12 V dc at 0 to 0.5 A, and −5 V dc at 0 to 0.5 A. Other specifications of the 1.1-lb units include overall regulation, ripple, and noise to within 1%, maximum peak-to-peak, and overvoltage and short-circuit protection.

The supplies, which are offered with an optional power-fail signal and a five-year warranty, conform to a number of Underwriters Laboratories and Federal Communications Commission safety specifications.

The switchers sell for under $1/W and can be delivered in 12 weeks.

Panasonic Industrial Co., 1 Panasonic Way, Secaucus, N.J. 07094. Phone (201) 348-7183 [Circle 372]

MEMORY SYSTEMS

Desktop unit combines disk with tape backup

A disk/tape subsystem that stores up to 300 megabytes on a disk in a desktop enclosure features an access time of 25 ms. To create the NMS 8003 subsystem, the firm combined the Pertec 8-in. 300-megabyte Winchester disk with its PC-9000 ANSI-compatible nine-track tape backup. Both are housed in its PC-8000 series desktop enclosure, which matches the IBM Personal Computer in appearance.

Orders for the preformatted and tested NMS 8003, priced at $12,900 in single-unit quantities, are being taken now for immediate delivery.

National Memory Systems Corp., 355 Earhart Way, Livermore, Calif. 94550.
Phone (415) 443-1669 [Circle 370]

Macintosh computers get 45-megabyte hard disk drive

A 5¼-in. Winchester disk storage system, a single-user version of the firm's OmniDrive unit, is designed for Apple Computer Inc.'s Macintosh computer. All the necessary communications software has been built into the drive, thereby eliminating complicated initialization procedures.

The Macintosh version of OmniDrive will be available this month in four capacities. A 5-megabyte version is priced at $1,795; 11-megabyte at $2,495; 16-megabyte at $3,195; and 45-megabyte at $4,995.

Corvus Systems Inc., 2100 Corvus Dr., San Jose, Calif., 95124.
Phone (408) 559-7000 [Circle 371]

LOCAL NETWORKS

Chip set aids Ethernet and Cheapernet

A three-chip set is designed to support both the Ethernet and Cheapernet local networks. The DP83HC90 network interface controller is designed to provide all functions of the data-link layer required for the transmission and reception of packets on an Ethernet/Cheapernet-compatible network, as specified in the IEEE 802.3 standard.

The controller features two 16-bit direct-memory-access channels and configures the buffer memory activity from the host DMA channels, minimizing use of the host processor. The model DP8391 serial network interface encodes and decodes serial data—using the Manchester coding scheme—and interfaces between the DP8390 controller and either the cable in Ethernet or the isolation transformers in Cheapernet.

The model DP8392 coaxial transceiver interface is designed to integrate the driver, receiver, jabber, and collision-detection circuitry. The chip uses a bipolar process that incorporates a thick epitaxial layer to foster reliability.

The three-chip sets, which will be available by the end of 1984, sell for $125 each in quantities of 100 sets or more.

National Semiconductor Corp., 2900 Semiconductor Dr., Santa Clara, Calif. 95051.
Phone (408) 721-5000 [Circle 375]

Gateway links Net/One and public data network

A gateway that creates an interface between the Net/One local network and a public data network supports up to 32 virtual circuits with an X.25 link speed of up to 64 kilobytes/s using RS-432-C, V.35, or RS-449 connections. The Net/One X.25 can be configured to interface either with a packet mode host on Net/One or with a public data network.

The gateway replaces up to 32 RS-232-C asynchronous connections to host computers with one synchronous link, allowing users to multiplex terminal traffic to a variety of host computers. The gateway is certified for use with the Telenet public data network and is expected to be certified for compatibility with AT&T's Accunet Packet Service. In addition, certification procedures are being conducted with Tymnet in the US and Datapac in Canada.

The manufacturer says major operating characteristics of the Net/One X.25 gateway can all be configured by using the company's Net/One Network Administrator. These characteristics include the number of gateway ports, the incoming call support, and the naming of ports.

Available this month, the gateway is priced at $10,090, plus $2,500 per network for software.

Ungermann-Bass Inc., 2560 Mission College Blvd., Santa Clara, Calif. 95050.
Phone (408) 496-0111 [Circle 377]

PLUG THE IBM PC INTO YOUR MULTIBUS CHASSIS

MULTIBUS USERS: You now have the full resources of the IBM PC or PC XT to use in your MULTIBUS system. The processing power of the PC coupled with its peripheral I/O and extensive software support makes it an excellent choice as the master processor or co-processor in your MULTIBUS application.

- Use the PC MACRO ASSEMBLER and PC DOS debug facilities to develop and test your MULTIBUS software.
- Directly address MULTIBUS memory as though it were PC memory.
- Directly address MULTIBUS I/O cards as though they were PC I/O cards.
- An 8K dual port concurrent access static RAM serves as a DMA buffer or as additional PC or MULTIBUS memory.
- A desk top MULTIBUS cabinet designed to match the styling of the IBM PC is available as an option.

Contact BIT 3 for details.

BiT3

Manufacturers Reps inquiries invited.

8120 PENN AVE. SOUTH
MINNEAPOLIS, MN 55431
(612) 881-6955

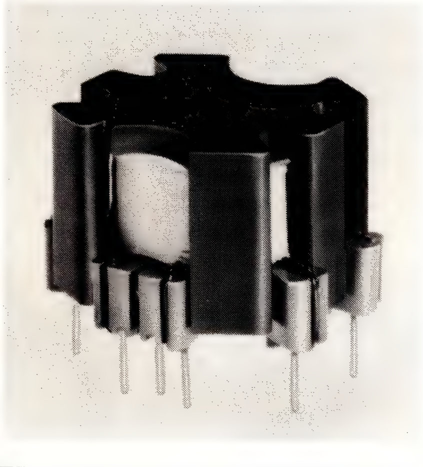
IBM is a trademark of IBM Corp.

Very dense thick-film capacitor dielectrics—Nos. 4113, 4114, and 4115—achieve excellent electrical performance even under very humid conditions. The high density of these materials permits them to withstand humidity without a glass binder. As a result, they achieve K values up to 100, above those of other available dielectric films, the company says.

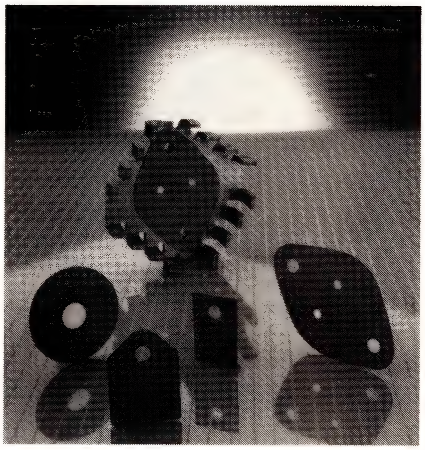
The materials fire at 850°C and show good adhesion to alumina. Laser trimming to precise capacitance values is possible. According to the company, the materials provide a cost-ef-fective alternative to discrete chip capacitors for capacitor arrays, delay lines, RC networks, and other applications. For more information, contact Electro-Science Laboratories Inc., 2211 Sherman Ave., Pennsauken, N.J. 08110 or phone (609) 663-7777.
[Circle reader service number 401]

Designed to improve performance in low-power (20 to 50 W) high-efficiency switching power supplies, the CS ferrite core configuration consists of two halves similar to pot cores but contains six slots placed 60° around its periphery for lead egress. Its printed-circuit mounting bobbin has large wire ways and terminals to accept large magnet wire. Ten terminals are provided: two groups of three terminals each in slots 180° apart and one terminal in each of the four remaining slots at 60° intervals.

The CS core and bobbin feature low-loss ferrite construction, a capacity for fine adjustment of output voltage, large bobbin terminals, standoffs to position the unit off the circuit board, keyed slots for wire separation to ensure correct insertion, and bobbin material that meets Underwriters Laboratories 94V-O flammability standards. To order or for more information, write to AIE Magnetics, 701 Murfreesboro Rd., Nashville, Tenn. 37210 or phone (615) 244-9024. [Circle 403]



Dry, thermally conductive pads—the series 400 Sil-Pads—provide up to 4,000-V insulation between heat sinks and semiconductors. The Sil-Pads, a low-cost alternative to grease and mica, provide better thermal conductivity than those materials do and are quicker to install.



Sil-Pads are clean and dry and do not attract dust or foreign particles. Unlike grease, they do not contaminate solvent cleaning baths or solder baths. They come in a wide variety of shapes and sizes and are also available with an adhesive coating on one side for easy application to integrated circuits, heat rails, or printed-circuit boards. The Sil-Pads are available from Aavid Engineering Inc., 30 Cook Ct., P.O. Box 400, Laconia, N.H. 03247, at phone (603) 524-4443. [Circle 404]

FR flame-retardant grades of Santoprene, a thermoplastic rubber, are recognized by Underwriters Laboratories under the 746A safety standard. The various grades have UL-94 ratings ranging from V-O to HB. The oxygen index values of the FR grades range from 28 to 23.

Monsanto says that FR grades have the same superior physical properties and processing characteristics as general-purpose Santoprene grades. Applications for the FR grades include materials for electrical insulation and jacketing, rubber sheeting, and a variety of other products whose flammability is a concern.

FR Santoprene comes in colorable grades with a variety of hardness levels; grade 251-80 is priced at $1.85/lb in truckload quantities, grade 251-85 at $1.75/lb, grade 251-92 at $1.85/lb, grade 253-36 at $1.85/lb, and grade 253-50 at $1.65/lb. These colorable grades may be pigmented with standard olefinic color concentrates. For more information, write to Monsanto Polymer Products Co., 800 N. Lindbergh Blvd., St. Louis, Mo. 63167 or call (314) 694-8655. [Circle 402]

A complete line of sputtering targets designed for coating magnetic memory disks is available in different geometries to accommodate any manufacturer's sputtering equipment. Sputter coating can be a faster, cleaner, and less expensive coating process than electrode-position techniques, such as electroplating or electrolysis plating.

Under the name UltraMag, target materials have also been developed for use with Varian Associates' own MDP-1000 Disk Sputtering System. For additional information, contact Varian Associates Inc., Specialty Metals Division, by writing to 3515 Grove City Rd., Grove City, Ohio 43123 or calling (614) 875-7912. [Circle 405]

A line of indium and indium-alloy solders has been added to Alpha Metals' line of solders and related chemicals for the electronics industry. Suitable for low-temperature metal-joining applications, the indium line includes wire, solder preforms, ribbon, shot, spheres, sheets, powders, and solder pastes. Most of the products can be shipped within 24 hours of receipt of order. To order, contact Alpha Metals Inc., 600 Rte. 440, Jersey City, N.J. 07304 or call (201) 434-6778. [Circle 406]

Secure upward mobility – or your links with W&G datacom test equipment

performance of datacom net-
ks can rise or fall. It will fall
tself. Its quality will rise with
er transmission errors, less
vntime, faster trouble analysis
quick removal of impair-
nts. Hence, test instruments
n Wandel & Goltermann can
g you a lot of help.
have designed 10 powerful
asuring instruments for trouble-
oting and field service of data
s. Covering all common ana-
and digital parameters. Up
ve will fit into the DMS-1, the
and match field case which
mits assembling test capability
cording to your specific needs.
ether for telephone companies,

or information networks within transportation, insurance and banking organizations, in fact, anywhere where data channels are found – we can help you with

the correct measurement tool.

★ Interface Testers (RS-/V. and X. access points)

★ Switching and patching of links-protocol and channel simulation

★ Modem Tester with bit- and block-error rate, bias distortion, timing measurements for V.24/RS-232C interfaces.

★ Data Circuit Measuring Set for impulse noise and drop-out according to CCITT O.71 and O.62.

★ Level Generator and Level and Noise Meter, 15 Hz to 20 kHz.

From the simple field instrument to the sophisticated protocol analyzer – come to W&G for your test needs. Ask for free information.

EL 6/8/84

E 2249 KF

Please send me:
☐ Information about the DMS-1
☐ Your "Data Product Line"
☐ An applications engineer

Name ....
Firm ....
Address ....
Street ....
Tel. No. ....

Wandel & Goltermann
P.O.Box 45 · Abt. VW
D-7412 Eningen u. A.
Fed. Rep. of Germany
Tel. +(49) 7121-8911
Telex 729833 wug d

Circle 131 on reader service card

Enter the new era of MICROSYSTEM DESIGN

MICROPROCESSOR SYSTEMS: Software and Hardware Architecture delivers a wealth of information about microcomputers, peripherals, networks, signal processing and software, that leads the field in the 80's!

This book is a comprehensive collection of technical articles, carefully detailed and presented, in exclusive reprints from *Electronics* Magazine.

Corporate Managers, Project Managers, Design Engineers, Market Managers: **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** is one book for all!

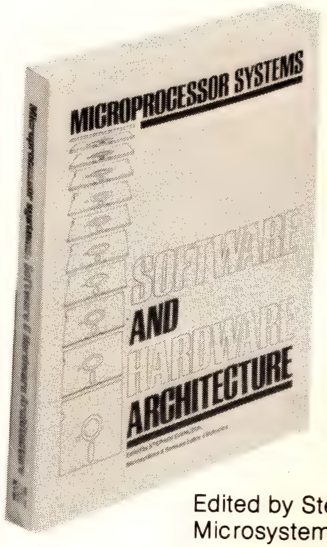
Six knowledgeable chapters examine:

- Significant trends in the development of new software systems and applications
- Technical articles on the manufacture of new microprocessors
- Approaches to memory management used by major chip manufacturers
- Conveniences of peripheral chips
- Alternative network methods from Ethernet to token-passing protocols
- Modular procedures for making digital signal processing systems

Engineers – Save precious time by eliminating a cumbersome series of software instructions.

Directed chiefly at design tactics, **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** helps you avoid errors and overcome all your architectural problems.

- Brings you the needed simplicity of design, without sacrificing performance of the finished system
- Offers a means of tapping microsystems into the power of mainframe machines
- Recounts major breakthrough in dedicated chips that handle math operations in record time



Edited by Stephen Evanczuk,
Microsystems & Software
Editor, *ELECTRONICS*

In one resourceful volume, **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** lets you understand:

- Functions of hour end microprocessors and controllers
- Key microprocessors that trigger the personal computer revolution
- The importance of dedicated chips more sophisticated than mainframes of yesteryear
- Significant aspects of microcomputer software
- Efficiency of peripheral-control chips

Here it is –

MICROPROCESSOR SYSTEMS: Software and Hardware Architecture - Let it design for you!

Don't be left in the dark: **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** illuminates the design process of an ever changing industry.

Don't delay -- order your copy today!

Use the coupon or send in your company purchase order.

MC GRAW-HILL PUBLICATIONS CO.
Attn: ECC
McGraw-Hill House
Maidenhead, Berkshire SL6 2QL
England
(Tel. (0628) 23431; Telex 848640)

Send me __________copy(ies) of MICROPROCESSOR SYSTEMS: Software and Hardware Architecture for $21.95 each. (U.S. residents please include local sales tax).

☐ Payment enclosed (postage & handling included)
☐ Bill me (postage, handling & tax will be added) NOTE: All orders under $30 will be sent a pro forma invoice requiring prepayment.
☐ Bill my company. Purchase order is attached.

Ship to:

Name ____________________

Company ____________________

Street Address ____________________

City__________State__________Zip__________

Country ____________________

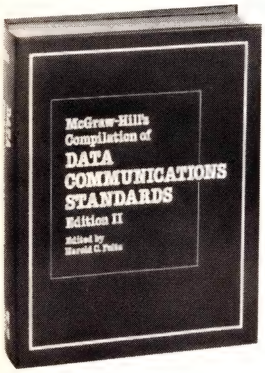
McGraw-Hill knows you will be satisfied, but if for some reason you are not, there is a ten-day money-back guarantee that applies on all books.

Allow four to six weeks for delivery.

NEW EDITION

Complete and Unabridged American and International

DATA COMMUNICATIONS STANDARDS



All standards are new, revised, or reaffirmed since the previous edition

1,923 pages
illustrated
Edited by Harold C. Folts

Presents all 123 interface protocol standards set by:
● International Telegraph and Telephone Consultative Committee (CCITT) ● International Organization for Standardization (ISO) ● European Computer Manufacturers Association (ECMA) ● American National Standards Institute (ANSI) ● Electronic Industries Association (EIA) ● U.S. Government (NBS and NCS)

Special feature for instant access:
Cross-reference tables of the standards of each group corresponding to those published by the others.

An essential reference for all who are exploring, planning, developing, manufacturing, or using data communications equipment or networks.

Return Coupon to:
Data Communications Standards II
Electronics Week Books
McGraw-Hill Inc.
Princeton Road
Hightstown, N.J. 08520
(Tel.) 609/426-5070

Send me ________ copy (copies) of **DATA COMMUNICATIONS STANDARDS EDITION II** at $250. U.S. orders please add local tax. McGraw-Hill pays regular shipping and handling charges on prepaid orders. Ten-day money-back guarantee applies.

☐ Check enclosed ☐ Bill me ☐ Bill company
☐ Company Purchase Order enclosed.

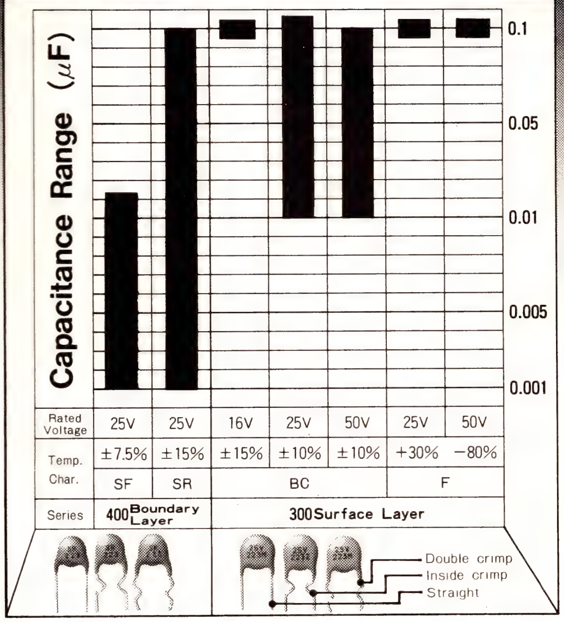
☐ American Express ☐ Visa ☐ MasterCard
____________ Interbank No.
Credit Card No. ________________ Expiration Date ______

Name ________________
Title ________________
Company ________________
Address ________________
City ________________
State/Zip (U.S.) ________________
Country (outside U.S.) ________________

ELV

COMPARED TO ANY EXISTING DIELECTRIC CERAMIC CAPACITOR

DIAMETER SHARPLY REDUCED BY 51% MORE COMPACT. GREATER CAPACITANCE.

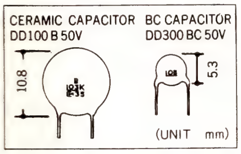


Rated Voltage	25V	25V	16V	25V	50V	25V	50V
Temp. Char.	±7.5%	±15%	±15%	±10%	±10%	+30%	−80%
	SF	SR	BC			F	
Series	400 Boundary Layer		300 Surface Layer				

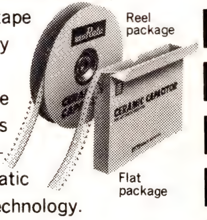
MURATA's BC capacitors are incredibly compact--51% smaller in diameter and 10% thinner than any existing dielectric ceramic capacitors. Despite their extremely compact size, MURATA's BC ceramic capacitors feature tremendously large capacitance ranging from 0.001 to 0.15uF. Yet, they are extremely stable in temperature characteristics, allowing you to minimize assembly cost via denser circuits and automatic chip insertion.

As modern electronic circuits become smaller and use lower voltages, they perfectly meet a variety of needs for by-pass coupling.

Comparison of external dimensions between BC capacitors and high-dielectric ceramic capacitors. (MURATA products)



MURATA also provides many components in tape packages for any automatic chip insertion machine together with its useful and high-precision automatic chip insertion technology.



SEMICONDUCTIVE CERAMIC CAPACITOR

BC CAPACITOR

☎ For details of BC CAPACITOR techniques, directly.

muRata ERIE

MURATA ERIE NORTH AMERICA, INC. ··········Phone:404-953-1799 Telex:542329
3002 Kingston Court, S.E., Marietta, GA 30067, U.S.A.
MURATA ERIE NORTH AMERICA, INC. CHICAGO OFFICE··········Phone:312-297-5560 Telex:281009
MURATA ERIE ELEKTRONIK GMBH (West Germany)··········Phone:0911-66870 Telex:623763
Kreuzsteinstr, 1A D-8500 Nürnberg 52, West Germany
MURATA ERIE ELECTRONIQUE S.A. (France)··········Phone:024-6767 Telex:699954
MURATA ERIE ELETTRONICA S.R.L. (Italy)··········Phone:688-4833 Telex:330385
MURATA ERIE ELECTRONICS (UK) LTD. (England)··········Phone:2514-28585 Telex:858971

muRata
MURATA MFG. CO.,LTD.

HEADQUARTERS 26-10, Tenjin2-chome, Nagaokakyo, Kyoto 617···Phone:075-921-9111 Telex:64270 MURATA J
MURATA ELECTRONICS SINGAPORE (PTE.) LTD. (Singapore)··········Phone:2554233 Telex:21127
TAIWAN MURATA ELECTRONICS CO., LTD. (Taiwan)··········Phone:042-91-4151 Telex:11348
(Taipei Office)··········Phone:02-562-4218
MURATA COMPANY, LTD. (Hong Kong)··········Phone:0-262099 Telex:56208
MURATA MFG. CO., LTD. Seoul Branch (Korea)··········Phone:720-7605/720-7321 Telex:25858

Circle 119 on reader service card

COLCOAT 515

STOPS

Electrostatic Damage

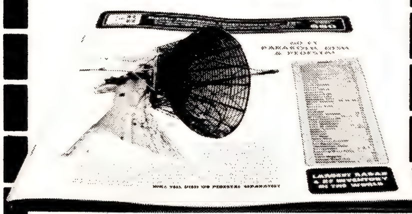
Protect delicate LSI and IC chips from electrostatic damage with COLCOAT 515, a unique, alcohol-based liquid. One application of COLCOAT 515 on a chip carrier case prevents electrostatic buildup for more than two years. It dries quickly to form a tough, protective coating.

Japan's leading electronics makers use COLCOAT 515 because of the almost 100% perfect protection it affords. The incidence of rejection due to damage from static electricity is less than one in a million. Specify COLCOAT 515 to ensure the damage-free deliveries your customers want.

COLCOAT CO., LTD.
3-28-1 Omori-nishi, Ota-ku, Tokyo 143, Japan.
Phone: (03) 762-8526. Telex: 0246-7481 COLCOT J

Circle 102 on reader service card

NEW!



COMPLETE ILLUSTRATED REFERENCE GUIDE TO THE LARGEST RADAR and RF INVENTORY IN THE WORLD

- RADAR SYSTEMS & RF SOURCES: 150 MHz to 35 GHz.
- ANTENNA MOUNTS: Autotrack, Search, X-Y, Nike Herc., Ajax, SCR-584. Capacity 50 to 20,000 lbs. Dishes to 60 ft. dia.
- RADAR INDICATORS
- PULSE MODULATORS
- HIGH VOLTAGE POWER SUPPLIES
- TUBES and PLUMBING

Radio-Research Instrument Co., Inc.
2 Lake Avenue Extension
Danbury, CT 06810
(203) 792-6666
TELEX 962444

ORDER YOUR FREE COPY TODAY!

Circle 120 on reader service card

Letters

The sources of C

To the Editor: Louis Schirm obviously misses the point about C or any other programming language (Letters, "C is the worst," May 31, 1984, p. 8). Anyone enamored with Basic will find C quite foreign.

All languages are rooted in the need to find efficient solutions to specific and, sometimes, to general problems. Basic, of course, is rather old. Newer languages build on the strengths of the past and avoid the weaknesses. Of all the new languages, C seems to be the most adaptable to virtually any application. It supports business, educational, and scientific applications; embedded processor systems; and even systems software. Can Basic make this claim? How about Fortran, Cobol, Pascal, and the others? Not likely.

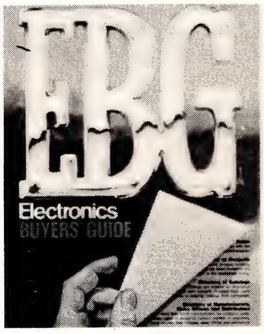
The outward appearances of a language do not always mirror its inner workings. Mr. Schirm's claim that $i+=2$ is the same as $i=i+2$ and conveys no useful information shows a failure to understand language and compiler processes. These two increment statements are in fact quite different. The statement $i=i+2$ represents a totally general form of incrementing. It adds two to a variable and puts the result in another variable. Contrary to Mr. Schirm's claim, $i+=2$ does indeed convey more information than $i=i+2$ does. It informs the compiler that only one variable is involved in the increment, so no other variable need be accessed. The time and code required to fetch, increment, and store the result is saved. We need only increment the variable.

Like any other language, C was not thrown together arbitrarily; it was created from necessity and a desire to improve the programming environment. C generates very compact, tight, and fast code. I resisted C at first, too. Now I embrace it. There seems to be a tendency to cling to the past for comfort. But this habit is dangerous and will prevent us from deriving the maximum benefit from technology.

G. Gaugler
McClellan Air Force Base
Sacramento, Calif.

NOW AVAILABLE!

1984-85
Electronics Buyers' Guide



Order your copy today for the industry's most often-used directory:

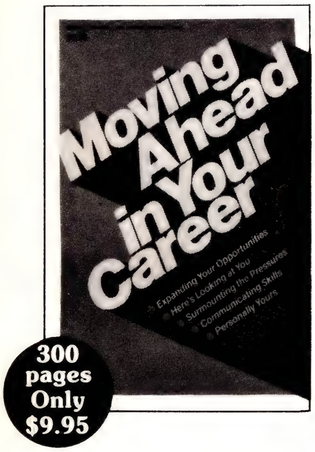
- It's three directories in one
- Includes more than 4,000 product listings. (approx. 700 pages)
- Contains over 5,000 company listings (approx. 400 pages) including:
  - Company name, address and phone number.
  - Name and title of contact for sales information.
  - Number of engineers at plant and number of employees.
  - Annual dollar sales volume.
  - Local sales offices and manufacturers representatives.
  - Local distributors.
  - Instant referral to company's advertisements.
- Offers FREE current catalog retrieval service (approx. 1300 catalogs)

Price: $40
in the U.S. and Canada

Send order with payment to:
Regina Hera
Electronics Buyers' Guide
1221 Avenue of the Americas
New York, NY 10020

Are you in your first engineering job?

Are you thinking about where you go from here?


Moving Ahead in Your Career
Expanding Your Opportunities
Here's Looking at You
Surmounting the Pressures
Communicating Skills
Personally Yours

300 pages Only $9.95

This book is a practical how-to-do-it guide from Graduating Engineer that you can put to use right now—articles like "How to Get a Good Performance Appraisal", "The Importance of a Mentor", "The Road to $50,000 a Year", "Winning at Office Politics"—and many more. Send for this book today and begin to move ahead in *your* career.

GRADUATING ENGINEER
P.O. Box 900
New York, NY 10020

Please send me ___ copies of "Moving Ahead in Your Career" at $9.95 each. Enclosed is my check/money order made out to Graduating Engineer for $______

Name

Address

City/State/Zip E

MANUFACTURING DEVELOPMENT PROJECT ENGINEER CONTROL SYSTEMS

Outstanding opportunity for an experienced Electronic/Electrical Engineer to assume key role in the development of state-of-the-art robotic and automation control technology. The individual we are seeking will have leadership responsibility for development and application of advanced micro-processor based robotic control systems incorporating state-of-the-art digital logic and/or micro-processor based power servos and computer interface equipment.

Candidates should possess a PhD or MSEE Degree or equivalent with 10 years of industrial experience. Must have demonstrated competence in advanced "real-time" microprocessor hardware and software system development including digital logic, power servos, computer interfaces for machine control applications. Assembly language experience required. Robotics experience desirable.

Ford Motor Company offers an excellent fringe benefits program and competitive salary. Applicants must possess a Citizenship or Visa status which permits them legally to accept permanent employment under U.S. Immigration laws. If this opportunity matches your qualifications and interests, for prompt consideration, please forward your resume and salary requirements in confidence to:

RESEARCH STAFF
Salaried Personnel —
MPL/MFJ-I
P.O. Box 2053
Room E-1141
Sci. Res. Labs. Bldg.
Dearborn, Michigan 48121-2053

Principals Only, Please

An Equal Opportunity Employer

POSITIONS WANTED

Microcomputer Expert for hire. Contract or perdiem. Programming, products with a brain, circuitry. Mr. Masel, 212-476-1516.

Engineering Consultant for U.L., U.L.C., or C.S.A. requirements. Call me for consulting, liaison, design aid. G. L. Schmitz 312-446-8775.

Instrumentation systems designer — contract/per diem. Automated acquisition and analysis systems. Hewlett Packard GenRad, Nicolett etc. Terry Mauney, PO Box 1702, Falls Church, VA 22041 (703) 820-9726.

POSITIONS VACANT

Gulf South Opportunities! Numerous openings in the Gulf Coast area for electronic engineers in the medical, computer and defense industries. All fees paid. For consideration send resume or call collect to Ann Jernigan, Snelling and Snelling, 428 Plaza Bldg., Pensacola FL 32505, (904) 434-1311.

Engineers — Discreet, Personal, Reputable. National-fee paid. Murkett Assoc., Box 527, Montgomery, AL 36101.

Electronic Engineers

Are your plans bigger than your employer's?

Electronic engineers often work for big companies on big projects. Accordingly, they make big plans for their future. But if you've ever worked for a large company you know that you can plan on one thing for certain: that your best efforts—much like your aspirations—often go unrecognized.

A Big Difference

At Martin Marietta Aerospace, you'll find that we have a different way of working together. Our matrix organizational structure gives you more opportunity to advance your career quickly. We planned it that way. Here you'll find broader responsibilities. You'll work on more projects with a wider variety of people. As a result, the contributions you make receive wider recognition and your career moves ahead according to your plans.

Plan On This

Today, Martin Marietta is growing faster than ever. Our location, at the foothills of the Rocky Mountains in Denver, Colorado, features some of the finest facilities in the world. And we're investing millions more to expand them.

Electronic engineers will play a major role in accomplishing our goals in the near future. If you want to be one of them, contact Martin Marietta Aerospace today. It could be that your plans and our plans look very much the same.

MARTIN MARIETTA

Martin Marietta Aerospace has professional opportunities available for engineers with at least 3 years experience in:

ELECTRONIC ENGINEERS

Guidance and Control Spacecraft Analysts
Analysis of spacecraft attitude and control systems. Both analog and digital control systems experience.

RF/Microwave Hardware Engineers
Determine equipment specifications, source selection, monitor subcontractors and vendors, and review and approve acceptance test data.

Signal Collection Systems Engineers
Develop signal collection system requirements, specifications, design and analyses, also procurement and test support.

Communications Systems Engineers
Develop requirements, specifications and designs, perform link and other analyses.

Senior Millimeter Wave Systems Engineers
Develop requirements and specifications concepts and designs, also analyses of performance.

Antenna Engineers
Hardware and theoretical design of Aerospace antennas, including strip line, millimeter-wave, and very wideband antennas.

Electrical/Electronic Engineers
Power electronics hardware, with dc/ac inverters, ac/dc converters, battery chargers, circuit breakers, contactors, and induction motor starting. Familiar with high reliability hardened military electronics.

Microprocessor Hardware/Firmware Design Engineers
Microprocessor hardware/firmware design. Z80 assembly language desirable.

Fiber Optics Systems Design Engineers
Experience in fiber optics systems design of buses, networks, LANS, and writing proposals.

VLSI and VHSIC CAD/Software Development Engineers
CAD software development; VLSI and LSI design and implementation, VAX/VMS experience preferred.

Analog Circuit Design
Experience with operational amplifiers, active filters, stability and military or NASA programs, plus design, breadboard test and worst case analysis.

Electrical/Electronic Parts Component Engineering Specialists
BSEE or BS Physics degree (equivalent experience acceptable). Experienced in piece part selection, application, qualification and procurement for military space applications of a wide range of microcircuits including memories, microprocessors and other new technology devices. Experience in single event upset technology is desirable.

Electrical/Electronic Parts Component Engineering Specialists
BSEE or BS Physics degree (equivalent experience acceptable). Experience in piece part selection, application, qualification and procurement. Familiarity with manufacturing processes, test techniques, state-of-the-art devices, source control drawing preparation and circuit application for capacitors, resistors, connectors, inductors, or transformers for use in military or space application is especially desired.

Electrical/Electronic Part Component Engineers
BSEE degree. Five years experience in electrical/electronic parts component engineering specialty to perform a lead function developing plans, directing part specialists, interfacing with customer project planning and project management. Must be familiar with military part specifications, control documents, and parts program requirements.

Radiation Effects Analysts
BSEE or BS Physics degree. Challenging positions in electronic circuit analysis and design involving radiation effects, TREE analysis, EMP, photon shielding, hardening options and testing are available for engineers with electronic design and analysis experience.

VLSI Design Engineers
BSEE degree. VLSI and VHSIC development opportunities are offered involving the most advanced radiation hardened technologies. Experience in either CAD or VLSI development are necessary.

Worst Case Analysis
Experience in digital, analog or power systems design and analysis including worst case circuit analysis.

Parts Test Engineer
Automated Tests Equipment experience with electronic component test knowledge, Tektronix 3260/3270 test system experience preferred.

Computer Aided Circuit Design
Computer circuit analysis programs including TEGAF and SPICE. Analog and digital analysis, model development.

Digital Circuit Design
Experience with TTL, CMOS, ECL, digital design and worst case analysis.

Power Conditioning Circuit Design Leads
Power conditioning circuit design, includes selection of circuit topologies and parts, circuit analysis and breadboard testing of power electronics for spaceborne power systems.

Solar Array Designer—Spacecraft Power
Solar array design for space applications, also analysis and performance prediction.

Power Systems Engineers
Spacecraft electrical power system design and analysis, including requirements definition and documentation, and performance prediction.

Analog Circuit Design and Analysis Engineers
Linear and non-linear circuits, oscillators, and precision feedback and control.

Electrical Distribution Designers
Experience in spaceborne cabling design, engineering requirements, fabrication and test.

Artificial Intelligence Specialists
Artificial Intelligence design with LISP programming experience.

Robotics Engineers
Control system design and robotics, including control system analysis, design, and fabrication.

Fight Data Subsystem Engineers
Spacecraft Command and Data Management System—analysis, design, and checkout of flight data subsystems.

Flight Data Systems Digital Design
Integrated circuit design and microprocessor application in deep space. Radiation hard design, HI/REL parts applications.

Flight Data System Analog Design
Operational amplifier and charge amplifier design for deep space. Active filter design, conversion (A/D, D/A). HI/REL parts application, and low noise characteristics.

Packaging and Cable Designers
Layout and design cabling for RF equipment. Working knowledge of RF technology and MIL Specs. as relates to packaging specifications.

Thermal Analysis Engineers
Spaceborne and ground electronics equipment, experience in both manual and computer analysis of complex spaceborne and ground electronics equipment.

Senior Product Design Engineering—Electronic Packaging
Design of complex spaceborne and ground electronic hardware using MIL SPECS. Conceptual design, coordination, design reviews, and mechanical analysis.

Printed Wiring Board Design Engineers
Design of high-density, multilayer PW boards to MIL SPECS, generate complete documentation package including artwork data base on a Computer Design Station.

RECENT EXPERIENCE ON GOVERNMENT/DOD STATE OF THE ART PROGRAMS A REAL PLUS.
SPECIAL BACKGROUND INVESTIGATION MAY BE REQUIRED.
Please send your confidential resume to: Martin Marietta Denver Aerospace, P.O. Box 179, L1311, P769, Denver, CO 80201. No agencies please, we prefer talking to the individual.
U.S. CITIZENSHIP REQUIRED
An Affirmative Action Employer
Actively Seeking the Veteran and Handicapped.

MARTIN MARIETTA

Think You Can't Afford Sunny California?

Check out the Sacramento Valley with Intel!

Call COLLECT Today— (916) 351-2004

You CAN find an affordable California when you join the technology leader in Non-Volatile Memories (NVM) in the beautiful Sacramento Valley. The views are spectacular in this historic valley, and housing costs are some of the lowest in California, as well as being very competitive nationally. You can have the lifestyle you've always dreamed of in an uncrowded area with many social, recreational and cultural opportunities, AND move in on the ground floor of an exciting new area of high technology. Intel's new Non-Volatile Memory facility in Folsom represents the next generation in electronics facilities, providing you with a working environment that's unsurpassed in comfort, resources and capabilities. The Sacramento Valley promises to be the next great high-technology center, and you could be there first!

Component Design Engineers

We have several positions available in CMOS Design Engineering. You will be responsible for designing leading-edge NVM and Static RAM technologies, both standard and custom, using the latest state-of-the-art CAD tools. Duties range from logic and circuit design to participating in product planning activities. Various positions exist from individual contributors with 2-4 years' experience to Project Design Managers with 5-10 years' experience. BSEE/MSEE preferred.

Product Marketing Engineers

Several positions are available with responsibility for introducing Static RAM's and E^2PROM's to the marketplace. Tasks will include pricing, demand forecasting, training other marketing and sales personnel, and assisting in the definition of new products. BSEE, MSEE preferred, with a minimum of 2-3 years' experience required.

Reliability Engineers

You will be responsible for quality and reliability issues, relating to E^2PROM, or SRAM devices, in addition to interactively working with other engineering departments and customers to achieve reliability and quality goals. Product line includes both plastic and ceramic packaging technologies. BS in EE or Physics, MS preferred, with 2-4 years' MOS experience required.

Move with Intel to Folsom. You'll find a collective commitment to excellence and outstanding career and lifestyle opportunities. Intel provides you with outstanding benefits including sabbatical, tuition reimbursement, and stock purchase programs. Please call **(916) 351-2004 COLLECT** or send your resume to: **K. Nelson, Intel Employment, Dept. 9409, 151 Blue Ravine, Folsom, CA 95630.** An Equal Opportunity Employer M/F/H.

intel®

STILL LOOKING FOR YOUR DREAM JOB?

Then be sure to check out the employment opportunities contained in ELECTRONICS WEEK Classified Section.

Or, why not consider placing a Position Wanted ad? The cost is low (only $2.35 per line) and the results are often rewarding. For more information call or write:

ELECTRONICS WEEK

Post Office Box 900
New York, N.Y. 10020
Phone 212/512-2556

COMPUTER SOFTWARE KNOW-HOW

If you've got it, advertise it!

Do you have software packages or services to sell? Or computer consultant skills to offer?

For as low as $107.25 per inch, you can advertise their availability in Electronics Week Computer Software Section.

Your message there will reach 102,000 technically-oriented decision-makers in the magazine they read to keep up-to-date on what's happening in their field.

To take advantage of this high readership—and an industry-wide interest in computer expertise—send your copy/art to the address below, or call New York telephone sales at 212/512-2556.

Electronics Week Computer Software Section

Post Office Box 900
New York, NY 10020

McGraw-Hill

1984 Electronics Week
COMPUTER SOFTWARE SECTION

Sizes		Material
1 inch	7/8 x 2 1/4	Artwork or
2 inch	1 7/8 x 2 1/4	film preferred.
3 inch	2 7/8 x 2 1/4	Typesetting
4 inch	3 7/8 x 2 1/4	free of charge.

1984 RATES

Unit	1X	6X	12X
1 inch	$107.25	$106.30	$105.40
2 inch	214.50	212.60	210.80
3 inch	321.75	318.90	316.20
4 inch	429.00	425.20	421.60

Telephone Sales: 212/512-2556

Electronics Week advertisers

	Advanced Micro Devices	6,7
	Amkor Electronics, Inc.	3
■	**Amp Incorporated**	10,11
	Augat	16
	Bit 3 Computer Corporation	99
■	**Allen Bradley**	3rd Cover
	Colcoat Co., Ltd.	102
	China External Trade	93
	Comdial	41,79
‡	**Computrol**	88
■	**Del Electronics Corp.**	93
	Digital Equipment Corp.	14,15
‡	**Electrohome Limited**	85
■	**Electronic Navigation**	12
	Electronics Week Magazine	59-61
	Elek Tek Incorporated	95
	ELXSI	56
	John Fluke Mfg Co.	21
	Force Computers Inc.	23
	Fuji Electrochemical	97
	Futurenet	2nd Cover
■	**General Instrument**	45
	Hamilton/Avnet Electronics	4th Cover
*	**Harting Elektronik**	39
	HEI, Inc.	89
	Hewlett Packard	1,13, 82, 83
*	**Hitachi America, Ltd.**	86-87
‡	**Hunter and Ready Inc.**	80
■	**ITT Cannon Electric**	65
‡	**ITW Switches**	66
	Krohn Hite Corporation	5
‡	**Kyowa Electronic Instrument Company Ltd.**	101
*	**Leader Electronics**	66

	Measurement Systems, Inc.	95
	Micrografx Incorporated	28
	Midwest Components	90
	Multi Solutions Inc.	37
*	**Murata Manufacturing Company Ltd.**	101
	National Semiconductor	54-55
	Nicolet Paratronics	9
	NKK Switches of America	53
	Ovenaire	46
■	**Radio Research Instrument**	102
‡	**Roder Electronics Inc.**	39
	S F E Technologies	47
*	**Siemens AG Munchen**	1E
	Sprague Electric	25
	SRD Corporation	46
*	**Stocko Electrical**	85
	Tandon Corporation	50-51
*	**Teac Corporation**	80
■	**Test Probe Inc.**	97
	Tektronix Incorporated	42-43
	Texas Instruments	49
‡	**Toshiba America, Inc.**	86-87
	Vacuumschmelze Gmbh	91
*	**Wandel & Goltermann**	3E
	Wilheim Westermann	40
	Xebec	26-27

Classified and employment advertising

Ford	103
Hayes Microcomputer	165
Intel	106
Martin Marietta	104, 105
Plessey Semiconductor	88

■ For more information of complete product line see advertisement in the latest Electronics Buyers Guide
* Advertisers in International
‡ Advertisers in domestic edition

August 6, 1984

Advertising Sales Staff

Atlanta, Ga. 30319: Maggie M. Dorvee
4170 Ashford-Dunwoody Road N.E.
[404] 252-0626
Boston, Mass. 02116:
607 Boylston St., [617] 262-1160
Chicago, Ill. 60611
Betsy A. Otto [312] 751-3739
William J. Higgens III [312] 751-3738
645 North Michigan Avenue
Cleveland, Ohio 44113:
[312] 751-3738
Costa Mesa, Calif. 92626: Larry Goldstein
3001 Red Hill Ave. Bldg. #1 Suite 222
[714] 557-6292

Dallas, Texas 75240: Harry B. Doyle, Jr.
5151 Belt Line Road, Suite 907
[214] 458-2400
Englewood, Co. 80112: Harry B. Doyle, Jr.
7400 South Alton Court Suite 111
[303] 740-4633
Fort Lauderdale, Fla. 33306: Maggie M. Dorvee
3000 N.E. 30th Place, Suite #400
[305] 563-9111
Houston, Texas 77040: Harry B. Doyle, Jr.
7600 West Tidwell, Suite 500
[713] 462-0757
Los Angeles, Calif. 90010: Chuck Crowe
3333 Wilshire Blvd.
[213] 480-5210
or [213] 480-5203
New York, N.Y. 10020
Matthew T. Reseska [212] 512-3617
Albert J. Liedel [212] 512-3616
1221 Avenue of the Americas
Palo Alto, Calif. 94303:
Larry Goldstein, Lauren Scott, Lynne Simonfy
1000 Elwell Court, [415] 968-0280
Philadelphia, Pa. 19102: Joseph Milroy
Three Parkway, [215] 496-3800
Pittsburgh, Pa. 15222: Joseph Milroy
Suite 215, 6 Gateway Center, [215] 496-3800
Southfield, Michigan 48075: Betsy A. Otto
4000 Town Center, Suite 770, Tower 2
[313] 352-9760
San Francisco, Calif. 94111:
Larry Goldstein, Lauren Scott, Lynn Simonfy
425 Battery Street
[415] 362-4600

Brussels: Art Scheffer
23 Chaussee de Wavre
Brussels 1040, Belgium
Tel: 513-73-95
Frankfurt/Main: Fritz Krusebecker, Dieter Rothenbach
19 Liebigstrasse, Germany
Tel: 72-01-81
Milan: Savio Pesavento
1 via Baracchini, Italy
Tel: 86-90-656
Paris:
17 Rue-Georges Bizet, 75116 Paris, France
Tel: 720-33-42
Scandinavia: Andrew Karnig
Kungsholmsgatan 10
112 27 Stockholm, Sweden
Tel: 08-51-68-70 Telex: 179-51
Tokyo: Akio Saijo
McGraw-Hill Publications Overseas Corporation,
Kasumigaseki Building 2-5, 3-chome,
Kasumigaseki, Chiyoda-Ku, Tokyo, Japan
[581] 9811

United Kingdom: Art Scheffer
34 Dover Street, London W1
Tel: 01-493-1451

Business Department

Frederick J. Kostbar
Business Manager/Controller
[212] 512-2627
Leon Irgang
Circulation Manager
[609] 426-5542
Hugh Donlan
Manager Circ./Direct Marketing
[609] 426-5541
Archie Anderson
Director of Marketing Services
[212] 512-6642
Margery D. Sholes
Research Manager
[212] 512-3191
Frances M. Vallone
Marketing Administration Manager
and Reader Service
[212] 512-6058
Thomas M. Egan
Production Director
[212] 512-3140
Carol Gallagher
Production Manager
[212] 512-2045
Betty Preis
Production Manager Domestic
[212] 512-2908
Evelyn Dillon
Production Manager Related Products
[212] 512-2044

Classified and Employment Advertising

[212] 512-2556

Editorial

AT LONG LAST, EXPORT SENSE?

There were indications last week that a compromise might be in the offing to untrack long-stalled legislation on the Export Administration Act. This is good news because as long as the question of what kind of computers and other types of high technology can be exported to friendly nations is unresolved, U.S. industry stands to lose what Peter McCloskey, president of the Electronic Industries Association, has said are "tremendous commercial opportunities for a very chancy potential saving" [*Electronics,* April 21, 1983, p. 61].

Recently, an agreement was forged among the North Atlantic Treaty Organization and Japan on a common policy regarding computer sales to the Soviet Union, and this has reportedly assuaged some of the concerns of the hardliners at the Department of Defense, led by Assistant Secretary Richard N. Perle. They believe that the Pentagon should have veto power over export licenses, a function that traditionally has resided in the Department of Commerce.

The bad news is that the so-called compromise—supported by Sen. Jake Garn (R., Utah), the chairman of Senate conferees on the joint congressional committee charged with reconciling differences in the bill between the two houses—consists of writing the DOD review authority over Commerce into the law. In view of the long-standing inflexibility of the Pentagon in trade matters, this compromise is not good business or good politics.

We believe the military should have a monitoring function in this area, but giving them the top control role would create long delays in export licensing procedures and could have serious, deleterious effects on U.S. standing in world technology markets, without achieving any additional security.

THE KEY IS ENFORCEMENT, NOT SOME MORE NEW LAWS

Avoidance of heavy-handed controls on dissemination of technology was also the subject of the articulate and intelligent keynote address by John R. Opel, chairman of IBM Corp., at the spring meeting of the American Association for the Advancement of Science. Calling for a restoration of U.S. economic competitiveness as well as for renewed vigor in science and technology, Opel urged that the West's open society must be maintained while instituting effective protection of militarily critical technology using ". . . more effective enforcement by our government and allies." However, he went on, "when we come to devising licenses and controls, we should exercise all possible precision and not try to put a little fence around everything."

Opel rightly believes in excluding from the list of militarily critical technologies "all those technologies that . . . are readily available in commerce." Instead, we should concentrate on what he terms "the most effective technology transfer mechanisms, such as turnkey factories and manufacturing techniques." And we particularly applaud his appeal to avoid controlling articles in technical journals, exhibits at trade shows, and conversation at academic conferences.

A-B
QUALITY

Our new RNK can cut your RN55D costs in half.

When you specify the new Allen-Bradley RNK, you will receive a metal film resistor with environmental specifications equal to or better than the RN55D (MIL-R-10509-F). And save from 30% to 50% on a commercial/industrial replacement for the RN55D. Allen-Bradley Company, 1201 S. Second St., Milwaukee, WI 53204. Write for more on the new Allen-Bradley RNK. Or contact your nearest Allen-Bradley sales office.

Circle 901 on reader service card

World's largest local distributor with 49 locations stocking the finest lines of electronic components and computer products

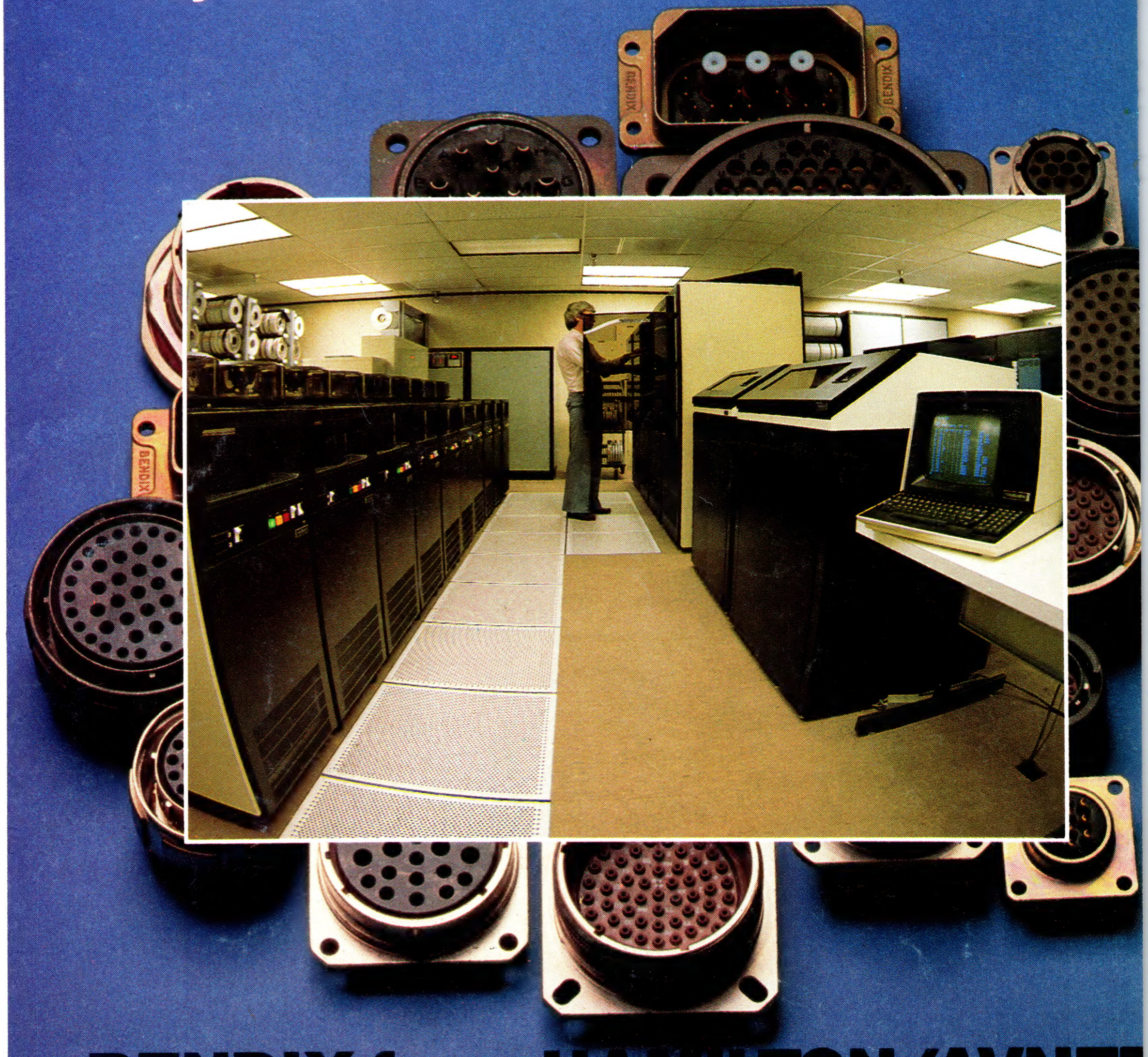
ALABAMA	
Huntsville	(205) 837-7210
ARIZONA	
Phoenix	(602) 231-5100
CALIFORNIA	
Avnet, L.A.	(213) 558-2345
Avnet, S.F.V.	(818) 700-2600
Avnet, O.C.	(714) 754-6111
Hamilton, L.A.	(213) 558-2121
Hamilton, S.F.V.	(213) 558-2323
Hamilton, O.C.	(714) 641-4100
Sacramento	(916) 925-2216
San Diego	(619) 571-7510
San Francisco	(408) 743-3355
San Gabriel	(714) 989-4602
COLORADO	
Denver	(303) 779-9998
CONNECTICUT	
Danbury	(203) 797-2800
FLORIDA	
St. Petersburg	(813) 576-3930
Miami	(305) 971-2900
Orlando	(305) 628-3888
Melbourne	(305) 725-2700
GEORGIA	
Atlanta	(404) 447-7507
ILLINOIS	
Champaign/ Urbana	(800) 625-8654
Chicago	(312) 860-7700
INDIANA	
Indianapolis	(317) 844-9333
KANSAS	
Kansas City	(913) 888-8900
Wichita	(800) 532-6720
KENTUCKY	
Louisville	(800) 428-6012
Lexington	(800) 543-4783
MARYLAND	
Baltimore	(301) 995-3500
MASSACHUSETTS	
Boston	(617) 273-7500
MICHIGAN	
Detroit	(313) 522-4700
Grand Rapids	(616) 243-8805
MINNESOTA	
Minneapolis	(612) 932-0600
MISSOURI	
St. Louis	(314) 344-1200
NEBRASKA	
Lincoln/Omaha	(800) 255-6702
NEW JERSEY	
Fairfield	(201) 575-3390
Cherry Hill	(609) 424-0100
NEW MEXICO	
Albuquerque	(505) 765-1500
NEW YORK	
Long Island	(516) 231-9800
Syracuse	(315) 437-2641
Rochester	(716) 475-9130
NORTH CAROLINA	
Raleigh	(919) 878-0810
OHIO	
Cleveland	(216) 831-3500
Columbus	(614) 882-7004
Dayton	(513) 433-0610
OREGON	
Portland	(503) 635-8831
PENNSYLVANIA	
Philadelphia	(215) 831-1300
Pittsburgh	(800) 321-6890
SOUTH CAROLINA	
Columbia	(800) 334-1597
TEXAS	
Dallas	(214) 659-4111
Houston	(713) 780-1771
Austin	(512) 837-8911
UTAH	
Salt Lake City	(801) 972-2800
WASHINGTON	
Seattle	(206) 453-5844
WEST VIRGINIA	
Charleston	(800) 543-4783
Huntington	(800) 543-4783
WISCONSIN	
Milwaukee	(414) 784-4510
INTERNATIONAL EXPORT	
Los Angeles	(213) 558-2441
New York	(516) 997-6868
Telex	66-4329
CANADA	
Toronto	(416) 677-7432
Montreal	(514) 335-1000
Ottawa	(613) 226-1700
Calgary	(403) 230-3586
Vancouver	(604) 272-4242
JAPAN	
Tokyo	(03) 662-9911

Hamilton Avnet

FOCUS ON SERVICE

YESTERDAY WE PROCESSED BENDIX CONNECTOR ORDERS REAL FAST...

Today We Process Them In Real Time Even Faster



BENDIX from HAMILTON/AVNE

We've done what we had to do to stay #1 in our field—we've made a good thing even better.

Our service of your Bendix connector requirements—always the industry standard—has now become even more streamlined through the Hamilton/Avnet computer network. With the Bendix bill of materials on line you can walk into any of our franchised locations and immediately know the availability of the components needed to fulfill your order. We can give you an exact quote on your requirements right there in the field.

Because our computer network functions in real time, all of our inventory information is programmed up to the second. In the instant your order is received into our system it's se into our value added assembly facility. In the instant your order is ready for delivery, shipping verification is generated electronically a the order is out the door and on its way to y

With the world's largest inventory of Bendi components and a computer network providi the ultimate in inventory control, it's no won Hamilton/Avnet is in a class of its own as a supplier of Bendix connectors. So call your local Hamilton/Avnet stocking facility today f all your Bendix requirements. And remember for all your small-quantity Bendix needs, ask for Express Lane Super Service—available exclusively from Hamilton/Avnet.

Hamilton Avnet
ELECTRONICS
A DIV. OF AVNET, INC.

A commitment to stock and serve your local market!

Circle 902 on
reader service c